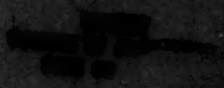

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A SEMI-MONTHLY ABSTRACT JOURNAL WITH INDEXES

AUGUST 8, 1964

VOLUME 2 ● NUMBER 15

N64-21495—N64-22725

DOCUMENTS

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VOLUME 2 NUMBER 15

Scientific and Technical Aerospace Reports

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August 8, 1964

01 GENERAL

Includes administration and management; space law and related legal matters; legislative hearings and documents; and symposia or conferences of a broad or general nature.

N64-21548 Toronto U. (Canada) Inst. for Aerospace Studies

ANNUAL BULLETIN, 1964

Mar. 1964 73 p

This bulletin is intended to provide prospective students of the aerospace engineering sciences with information concerning the programs offered at the University of Toronto, and to serve as a yearbook that contains a record of the various activities of interest and a roster of the student body, past and present. Included are a description of the institute for aerospace studies, teaching staff, facilities and research, degree programs in the aerospace engineering sciences, financial assistance to students, fees, admission procedure, UTIAS seminars 1963, staff notes, student notes, institute tours, B.A.Sc. graduates 1963, M.A.Sc. graduates 1963, Ph.D. graduates 1963, Profiles (Ph.D. class of 1952–1953), a list of graduate students in attendance 1963–1964, a list of fourth-year students in the aerospace engineering option (5a) of the engineering science course 1963–1964, and a list of UTIAS graduates (Ph.D. and M.A.Sc.) 1948–1963. R.T.K.

N64-21581 Army Research Office, Durham, N.C.

PROCEEDINGS OF THE EIGHTH CONFERENCE ON THE DESIGN OF EXPERIMENTS IN ARMY RESEARCH DEVELOPMENT AND TESTING

Dec. 1963 600 p refs Conf. held at Walter Reed Inst. of Res., Washington, 24–26 Oct. 1962

(AROD-63-2)

This volume of the proceedings contains 28 papers on modern statistical principles in the Design of Experiments, as well as certain applications of these ideas. I.v.L.

N64-21601 Federal Council For Science and Tech., Washington, D.C.

CURRENT PROBLEMS IN THE MANAGEMENT OF SCIENTIFIC PERSONNEL

[1963] 125 p Proc. of the First Symp., 17–18 Oct. 1963

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N64-21602 Agricultural Research Service, Washington, D.C.

CAREER DEVELOPMENT OF FEDERAL SCIENTISTS AND ENGINEERS–I. RECOGNITION OF RESEARCH COMPETENCE

Byron T. Shaw et al *In* Federal Council for Sci. and Technol. Current Probl. in the Management of Sci. Personnel [1963] p 3–28 (See N64-21601 15-01)

The system available at the Civil Service Commission for recognizing and rewarding research competence is discussed, and the utilization of this system at the Goddard Space Flight Center and at the Department of Agriculture is described. I.v.L.

N64-21603 Office of Naval Research, Washington, D.C.

CAREER DEVELOPMENT OF FEDERAL SCIENTISTS AND ENGINEERS–II. INCENTIVES AND EVALUATIONS

F. J. Weyl et al *In* Federal Council for Sci. and Technol. Current Probl. in the Management of Sci. Personnel [1963] p 28–45 (See N64-21601 15-01)

This report discusses the following: (1) problems that have arisen in the management of the various in-grade step increases that current personnel regulations allow, and the formulation of a program that would include both Ramspeck and incentive features—this program would provide incentives to the employees, flexibility to the supervisor, maintain the length-of-service principle, and clear up some of the semantics; (2) the Salary Reform Act that gave the Federal manager two new authorities to control the take-home pay of his employees. The positive side is the quality increase, the extra increase no more than once a year for the person whose work is of high quality; the other side is the authority of management to grant the regular increase only if work is of an acceptable level of competence, as determined by the department head; and (3) the Incentive Awards Act with special rewards, either commendations or money, all the way from a dollar bill to $25,000 for unusually competent performance. I.v.L.

N64-21604* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CAREER DEVELOPMENT OF FEDERAL SCIENTISTS AND ENGINEERS—III. THE SENIOR SCIENTIST
Harry J. Goett et al *In* Federal Council for Sci. and Technol. Current Probl. in the Management of Sci. Personnel [1963] p 46–69 (See N64-21601 15-01)

The following topics are reviewed: (1) the statutory and administrative framework governing the appointment and promotion of scientists and engineers to top levels in the Civil Service Commission system; (2) the policy of the Department of Defense for providing an orderly career structure for the top technical personnel through the combined use of Public Law 313 and nonquota supergrade authorities; and (3) the possibility of merging Public Law 313 and Section 208(g) of the Public Health Service Act into one operable group at NIH. I.v.L.

N64-21605 Smithsonian Institution, Washington, D.C.
CURRENT CONTROVERSIES IN SCIENTIFIC PERSONNEL ADMINISTRATION
Leonard Carmichael et al *In* Federal Council for Sci. and Technol. Current Probl. in the Management of Sci. Personnel [1963] p 69–91 (See N64-21601 15-01)

Personal attributes and interpersonal relations of scientists are discussed. Topnotch scientists have, without exception, a high degree of personal involvement in the job they are doing. It matters more to them than anything else. They also possess a high degree of curiosity. Scientists in various fields differ in verbal, mathematical, and spatial test ratings; these differences are discussed. Scientists prefer mental manipulations involving things rather than people. Their general interpersonal attitude is one of indifference, or withdrawal. They tend to be dominant, but not controversial, personalities. They do not want to be pushed around but, for the most part, neither are they likely to be pushing anyone else around. In dealing with the neurotic differences among scientists, their characteristic mechanism is to repress difficulty or to get away from it. Also, the problem of identifying the superior scientist, especially before he becomes superior, is discussed. I.v.L.

N64-21606 Civil Service Commission, Washington, D.C.
LOOKING AHEAD IN FEDERAL SCIENCE ADMINISTRATION
John W. Macy, Jr. *In* Federal Council for Sci. and Technol. Current Probl. in the Management of Sci. Personnel [1963] p 92–104 (See N64-21601 15-01)

Government-operated laboratories are proposed. Aspects of the proposal discussed include a rational management approach, staffing, locations, and compensations and benefits. I.v.L.

N64-21607 Geological Survey, Washington, D.C.
CONFLICT OF INTEREST AND THE FEDERAL SCIENTIST
Thomas B. Nolan et al *In* Federal Council for Sci. and Technol. Current Probl. in the Management of Sci. Personnel [1963] p 104–121 (See N64-21601 15-01)

The following topics are reviewed: (1) problems presented to the Federal scientist and to the manager in determining the extent to which the Federal scientist can participate in education and in university activities; (2) the outside interests of the Federal scientist—the degree to which he may participate, either through investments or through consulting services, in areas that are related to but not directly concerned with his own employment; and (3) problems that are presented by the Federal scientist as a result of his development of new ideas, which he proposes to regularize, either through the patent mechanism or through the preparation of papers or books for outside publication. I.v.L.

N64-21626 Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COSMIC RESEARCH
29 Oct. 1963 345 p refs Transl. into ENGLISH from the book "Kosmicheskiye Issledovaniya", vol. I, no. 1 Moscow, Izd. Akad. Nauk SSSR, 1963 p 1–192
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N64-21779 Air Force Systems Command, Wright-Patterson AFB, Ohio AF Materials Lab. and Directorate of Systems Dynamics Analysis

STORAGE AND RETRIEVAL OF WYANDOTTE-ASTM INFRARED SPECTRAL DATA USING AN IBM 7090 COMPUTER Technical Report, Oct. 1961–Oct. 1963

Lee D. Smithson, Leonard B. Fall, Frederick D. Pitts, and F. W. Bauer Feb. 1964 29 p refs

(RTD-TDR-63-4265; AD-431720)

The work described was performed to determine the practicability of using existing infrared punched card data with an IBM-7090 computer to improve storage and retrieval. Prior to this work, Wyandotte-ASTM punched cards were used with sorting machines for the purpose of matching infrared spectra in qualitative analysis and for correlating chemical structure and absorption band positions. The increasing amount of data (10,000 cards per year) made it desirable to find a faster sorting system. The data from 51,734 Wyandotte-ASTM infrared punched cards were transferred to a magnetic tape, and a computer program was written that allows for any logical sorting operation to be performed. The program was designed for as many as 36 separate problems or requests. The significance of this program lies in the almost immediate identification of unknown compounds that are amenable to analysis by infrared spectroscopy provided that a spectrum of the compound is indexed by the Wyandotte-ASTM punched cards. Also, this computer program can be used with the ultraviolet, visible, near infrared, far infrared, mass spectra, and X-ray Wyandotte-ASTM data cards, as well as with any type of punched card data.

Author

N64-21817 Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS

May 1964 57 p refs

OTS: $1.25

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1. THE NRL SOLAR MONITORING SATELLITE PROGRAM R. W. Kreplin p 1–10 (See N64-21818 15-32)
2. ATTENUATED TOTAL REFLECTANCE-INFRARED SPECTROSCOPY AS AN ANALYTICAL TOOL R. A. Miller and F. J. Campbell p 11–16 refs (See N64-21819 15-07)

SCIENTIFIC PROGRAM

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N64-22060 Los Alamos Scientific Lab., N. Mex.

SOME ETHICAL AND SOCIAL PROBLEMS OF SCIENCE AND TECHNOLOGY: A BIBLIOGRAPHY OF THE LITERATURE FROM 1955

J. Arthur Freed, comp. 6 Feb. 1964 48 p refs

(Contract W-7405-ENG-36)

(LAMS-3028) OTS: $1.25

N64-22200 Lockheed Missiles and Space Co., Sunnyvale, Calif. Technical Information Center

LONG-RANGE PLANNING AND TECHNOLOGICAL FORECASTING: AN ANNOTATED BIBLIOGRAPHY

Peter R. Stromer, comp. Nov. 1963 46 p refs

(SRB-63-12; Rept.-5-47-63-1)

A survey was made of the recent aerospace and business management literature covering the broad spectrum of long-range planning and technological forecasting. While emphasis was placed on applicability to the aerospace and defense industry, additional inputs detailing the general philosophy and techniques of industrial and government planning and related subject fields of economic projections, resource allocations, and cost analyses have been included. A subject index facilitates use of this material. Author

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes aerodynamics of channels, cowls, ducts, ejectors, nozzles, etc. *For related information see*: 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 11 Fluid Mechanics.

N64-21555 Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

A METHOD OF DETERMINING FLOW FIELDS OF BLUNT-NOSED SLENDER BODIES AT ARBITRARY ANGLES OF YAW

V. L. Reed Jan. 1964 38 p refs

(Contract DA-01-021-AMC-85(Z))

(TN-R-85; AD-439008)

Blunted slender bodies at angles of yaw have been a major problem for aerospace engineers and scientists for several years. A method is proposed whereby the well-known similarity solution, i.e., blast wave theory, may be used with modifications to predict experimental data to a high degree of accuracy. The yawed body is examined, and the shock surface is located on a hemisphere–cylinder combination. Further methods are proposed for evaluation of prolate spheroid–cylinder and blunted-cone configurations. Author

N64-21558 Marquardt Corp., Van Nuys, Calif.

AN ANALYTICAL STUDY OF ROTATIONAL FLOW WITH SHOCKS FOR TWO-DIMENSIONAL OR AXISYMMETRIC GEOMETRIES AS APPLIED TO A SPIKE INLET

P. J. Aucoin, Jr. and A. E. Heins, Jr. 10 Oct. 1963 68 p

(Contract AF 33(657)-10795)

(Rept.-6011; AD-423532)

The FORTRAN program described in this report is intended for use in computing the inviscid flow field of a hypersonic inlet. The inlet consists of a curved spike with a blunt tip, followed by an internal contraction section, and it can be either two-dimensional or axisymmetric. Curved shocks will stand in front of both the spike tip and the cowl. The effects

of entropy gradients (rotational flow) due to such shocks are included in the analysis. The method of construction of shock reflections from either the inner or outer wall and shock formation due to coalescence of characteristic lines is described. Author

N64-21586 General Electric Co., Philadelphia, Pa. Re-Entry Systems Div.
TURBULENT BASE FLOW BEHIND A SLENDER SUPERSONIC RE-ENTRY VEHICLE
Joseph Brown 7 May 1964 26 p refs
(Contract AF 04(694)-222)
(Rept.-6350849; AD-439219)

A method is developed for determining the geometry and fluid mechanical properties of the base flow region behind a slender supersonic reentry vehicle. The analysis provides thermodynamic function profiles suitable for calculating infrared radiation, streamlines for calculating electron density formation for determining radar cross section, and starting conditions for a postneck wake calculation. An example is worked out on the basis of a nonequilibrium-chemistry stream tube analysis, which indicates that the radar cross section of the base flow region provides a negligible radar cross-section contribution to the wake. Author

N64-21587 Pennsylvania State U., University Park Ordnance Research Lab.
AN INVESTIGATION OF THE FORCES ON AN AIRFOIL OSCILLATING IN PITCH ABOUT THE QUARTER CHORD
F. E. Smith and M. Sevik 12 Mar. 1964 80 p refs
(Contract NOw-63-0209-c)
(TM-607.2441-02; AD-438890)

The lift and moment on an airfoil oscillating in pitch about the quarter chord line in an incompressible noncavitating flow have been determined experimentally. Theoretical values were obtained by using Theodorsen's analysis. The contributions of the various terms in the theory were investigated to explain the deviation between theory and test results. At high values of the reduced frequency parameter, defined as the ratio between a characteristic body length and a wavelength of the hydrodynamic disturbances, it is known that existing theories are unreliable. This fact is supported by the results of this investigation. The report examines some of the basic assumptions underlying existing theories such as the satisfaction of the Kutta–Joukowski trailing-edge condition and also presents some photographs of the vortex formation in the wake of an oscillating airfoil. Author

N64-21696 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (W. Germany)
STRENGTH AND AEROELASTICITY Report on Meeting of the Professional Committee [FESTIGKEIT UND AEROELASTIZITAT Bericht über die Sitzung des Fachausschusses]
H. G. Küssner and W. Schnell [1963] 20 p in GERMAN
(WGLR-10/1963) WGLR: 6 DM

Excerpts from the following papers are presented: (1) "The Effect of Notches on Strength under Conditions of Static and Repetitive Stress"; (2) "Fractographic Investigations of Crack Propagation"; (3) The Estimation of the Lifetime of a Supersonic Transport Airplane, Evaluation of Kinetic Heating"; (4) "The Influence of Elevated Temperature, under Repetitive Stress, on Fatigue and Creep Characteristics"; (5) "An Illustration of Random Successive Consumable Loads of Aircraft during Fatigue Tests"; (6) "Lifetime and Crack Propagation under a Combined Stress of Ordered and Random Successive Loads"; and (7) "General Research Problems of Fatigue Strength in the German Republic." I.v.L.

N64-21700 Aeronautical Research Council (Gt. Brit.)
LOW SPEED WIND TUNNEL TESTS ON A KITE BALLOON MODEL
M. H. Simonds London, HMSO, 1963 14 p refs
(ARC-CP-643 Replaces RAE-TM-AERO-2799) HMSO: 2s. 6d.

Low-speed wind-tunnel tests, aimed mainly at finding certain lateral aerodynamic stability derivatives, were carried out on a rigid 1/80th scale model of a 70,600 ft^3 kite balloon. The lift, drag, and pitching moment, and the variation with angle of sideslip of the static values of side force and yawing moment were found. In dynamic tests, the aerodynamic damping of free oscillations in yaw was measured about three separate axes of rotation. From these measurements the following combinations of stability derivatives were found: $(n_r - n_{\dot{v}})$, $(n_v - y_{\dot{v}} + y_r)$ and y_v. Results were obtained for the model at zero incidence, with the fins in place and with them removed. Author

N64-21701 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Institut für Strahlantriebe
THE COURSE OF BOUNDARY MACH CURVE IN THE SMALLEST CROSS-SECTION OF SYMMETRICAL AND AXIALLY SYMMETRICAL LAVAL NOZZLES [DER VERLAUF DER GRENZMACHLINIE IM ENGSTEN QUERSCHNITT EBENER UND ROTATIONSSYMMETRISCHER LAVALDUSEN]
E. Riester and H. Hardegen Sep. 1963 35 p refs In GERMAN
(DFL-219)

Approximate solutions are developed for the pattern and the flow sizes along the so-called limiting Mach line. This line is the Mach line farthest downstream from which disturbances of the sound line pattern can take effect. It yields the farthest downstream contour point of a nozzle, from which an expansion angle may begin (thereby attaining the shortest possible nozzles). Further, the knowledge of the limiting Mach line in formula form makes it unnecessary to construct the Mach line network between the sound line and the limiting Mach line. The method of characteristics can be fitted downstream of the limiting Mach line. Trans. by D.E.W.

N64-22023* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF DISTRIBUTED ROUGHNESS HEIGHT ON AERODYNAMIC CHARACTERISTICS AND BOUNDARY-LAYER TRANSITION OF A WING-BODY-TAIL CONFIGURATION AT A MACH NUMBER OF 1.61
Roy V. Harris, Jr. Washington, NASA, Jun. 1964 22 p refs
(NASA-TN-D-2334) OTS: $0.50

An investigation was conducted in a 4- × 4-ft supersonic pressure tunnel to determine the effects of three-dimensional roughness trips on the boundary-layer transition and the longitudinal aerodynamic characteristics of a wing-body-tail configuration at a Mach number of 1.61. The tests were made throughout a range of free-stream Reynolds numbers per foot from about 0.6 million to 8.0 million with the model angle-of-attack adjusted to produce zero lift. Tests were made without boundary-layer trips and with trips of different roughness heights. At three test Reynolds numbers, data were recorded throughout an angle-of-attack range from about −1° to 12° with several roughness sizes and without the trip. As would be expected, the data indicate that the larger roughness particles produce a fully turbulent boundary layer at a lower free-stream Reynolds number than the smaller roughness particles. At the highest Reynolds numbers per foot (greater than about 6.0×10^6), the drag levels appear to increase above the theoretical turbulent level. When the boundary layer was not fully turbulent

at zero lift, small increases in the lift coefficient produced drag increases that indicated that the character of the boundary layer was approaching the fully turbulent condition. The pitching moments and lift coefficients were unaffected by variations in either grit size or Reynolds number. Author

N64-22100 Aeronautical Research Inst. of Sweden, Stockholm
A PROGRESS REPORT ON THE FFA HYPERSONIC GUN TUNNEL
E. G. Brown-Edwards Nov. 1963 26 p refs
(Sponsored by Roy. Swed. Air Board)
(AU-11-166:1)

A nozzle, designed for a Mach number of 12, and a test section have been added to the FFA shock-compression heater. These are described and some preliminary experiments are discussed. The experiments consist mainly of a pitot-pressure calibration of the working section and schlieren photography of the flow over various models. Author

N64-22108 Boeing Scientific Research Labs., Seattle, Wash.
PRECURSOR AND OTHER EFFECTS IN THE ELECTRICALLY DRIVEN SHOCK TUBE Flight Sciences Laboratory Report No. 85
H. G. Ahlstrom (Washington U.), D. W. Mahaffey, L. Sanga, and R. I. Schoen Dec. 1963 34 p refs
(DI-82-0321)

This report is concerned with the nature, cause, and magnitude of some of the precursor effects and separation of the shock from the hot gas associated with the discharge of the 6-in. electromagnetically driven shock tube. The main precursor effect was caused by vacuum ultraviolet radiation. Impurities in the gas were probably ionized. Although there is pictorial evidence that a well-formed shock is not found in the first meter or so of the shock tube, it is evident that such does form further down the tube and can be separated from the driver gases. N.E.A.

N64-22486 McGill U., Montreal (Canada) Mechanical Engineering Research Labs.
TWO-DIMENSIONAL TURBULENT WALL JETS OVER CURVED SURFACES
D. E. Guitton Jun. 1964 109 p refs
(Rept.-64-7)

The flow of incompressible turbulent wall jets over curved boundaries is examined. The experimental portion is concerned with the flow of the jet on a concave surface of constant radius. The theoretical portion of the investigation considers jets blown over surfaces for which the radius is proportional to the jet thickness and is constant. The former defines flows for which the form of the velocity profiles will remain unchanged downstream. The solutions for both cases are obtained by neglecting wall friction and by assuming a turbulent shear law that is similar in form to that for curved laminar shear flow. Author

N64-22570 ARO, Inc., Arnold Air Force Station, Tenn.
SUPERSONIC AXISYMMETRIC NOZZLE DESIGN BY MASS FLOW TECHNIQUES UTILIZING A DIGITAL COMPUTER
W. C. Moger and D. B. Ramsay Arnold Engineering Development Center, Jun. 1964 59 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-110; AD-601589)

This report presents a method to design the inviscid wall contour of a supersonic, axisymmetric nozzle producing uniform parallel flow at the exit. The calculation methods used are restricted to a perfect gas. The axis velocity distribution must be specified. A complete flow pattern within the nozzle is computed by the method of characteristics beginning at Mach 1.0 on the axis and extending to the region of uniform parallel flow at the exit. The wall points are calculated by means of a mass integration technique. The methods of calculation included were programed in FORTRAN II language, and a complete listing of the program is given. Author

N64-22644 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPLICATION OF THE ASYMPTOTIC METHOD OF CERTAIN PROBLEMS OF THE DYNAMICS OF VEHICLES
V. A. Yaroshevskiy 14 Mar. 1963 21 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 2, no. 2, 1962 p 211–221
(FTD-TT-63-164/1+2+4; AD-401744)

The article generalizes and reduces to a compact form the rule of the conservation of the adiabatic invariant. As an example of applying the formulas obtained, problems concerning orbital decay of a satellite, the skip-glide motion of a glider, and the oscillations of a vehicle about the center of mass on a flight path with a variable velocity are examined. Author

N64-22660 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MEASURING PULSATING PRESSURES WITH THE AID OF MEMBRANE TRANSDUCERS
Yu. G. Zakharov 2 Jan. 1964 21 p refs Transl. into ENGLISH from Prom. Aerodinamika (Oborongiz), no. 19, 1960 p 9–20
(FTD-TT-63-737/1+2+4; AD-433076)

When using a transducer to measure pressure changes in an airstream it is not always possible to place the transducer directly at the point of interest. Under these conditions the pressure that is being studied is brought to the transducer through a channel consisting of an input nipple, a connecting tube, and an air cavity formed by the transducer housing and the membrane. An attempt is made to determine experimentally the correction factors for the measured amplitude and phase of a pulsating pressure, by considering the transducer and the inlet tube as a single oscillating system. P.V.E.

N64-22673* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CORRELATION GRAPHS FOR SUPERSONIC FLOW AROUND RIGHT CIRCULAR CONES AT ZERO YAW IN AIR AS A PERFECT GAS
Mitchel H. Bertram Jun. 1964 23 p
(NASA-TN-D-2339) OTS: $0.75

From these graphs the pressure, density, temperature, shock angle, and Mach number may be obtained both at the cone surface and immediately behind the shock, for free-stream Mach numbers, from that for shock detachment to that approaching infinity and for cone semiapex angles up to 50°. In addition, the initial slope of the normal-force curve is given for the same range of conditions. Author

N64-22682 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
PRESSURE AND HEAT TRANSFER MEASUREMENTS FOR MACH 8 FLOWS OVER A BLUNT PYRAMIDAL CONFIGURATION WITH AERODYNAMIC CONTROLS. PART IV: HEAT TRANSFER DATA FOR DIHEDRAL SURFACES. PART OF AN INVESTIGATION OF HYPERSONIC FLOW SEPARATION AND CONTROL CHARACTERISTICS
Louis G. Kaufman II Wright-Patterson AFB, Ohio, Flight Dyn. Lab., May 1964 128 p refs
(Contract AF 33(616)-8130)
(FDL-TDR-64-2, Pt. IV; AD-601350)

Pressure and heat-transfer data were obtained for Mach 8 flows over a blunt pyramidal configuration composed of a 70° sweep-back delta wing surface and two dihedral surfaces. Trailing-edge flap deflections were varied up to 40° on all surfaces, and the model was tested with and without canards and ventral fins. The model was pitched at angles-of-attack between ±54° and was tested at sideslip angles of 0° and 12° for free-stream Reynolds numbers, based on model length, of 1.5 and 4.5 million. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N64-21515 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
HYDROFOIL FLUTTER SMALL SWEEP ANGLE INVESTIGATION Final Report
Charles E. Squires, Jr. Nov. 1963 42 p refs
(Contract Nonr-3989(00))
(DA-NONR-3989.3; AD-434258)

Analytical and experimental studies were performed defining the general behavior of hydrofoil struts for low sweep angles (0° to 10°). In general, the flutter frequency drops smoothly with decreasing sweep angle and becomes exactly zero at the intersection of the flutter and static divergence boundaries. Therefore, contrary to previous speculation, no flutter-free range of sweep angles exists immediately above the static divergence boundary. Possible exceptional cases are discussed, and the effects of span length, frequency ratio, and elastic axis location are briefly examined. The significance of current design trends and a flutter analysis of a typical design are discussed. Author

N64-21704 Deutsche Forchungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Inst. für Strahlantriebe
THE APPLICATION OF EJECTORS TO V/STOL AIRCRAFT AND THEIR DESIGN, PART 1. PARTIAL REPORT [DIE ANWENDUNG DES EJEKTORS BEI V/STOL-FLUGZEUGEN UND DESSEN AUSLEGUNG, 1. TEILBERICHT]
C. Storkebaum Feb. 1964 58 p refs in GERMAN
(DFL-234)

Compressible and incompressible ejectors are discussed in light of using ejectors in V/STOL aircraft. The effect of parameters, such as pressure, temperature, and aspect ratio, on the expected thrust increase is graphically illustrated.
Trans. by I.v.L.

N64-21754 Therm, Inc., Ithaca, N.Y.
THE GENERALIZED ACTUATOR DISK
G. R. Hough and D. E. Ordway Jan. 1964 37 p refs
(Contract Nonr-2859(00))
(TAR-TR-6401; AD-433976)

Based upon the classical vortex system representation, the induced velocities of a finite-bladed propeller with arbitrary circulation distribution are derived and Fourier-analyzed. The zeroth harmonic, or steady component, of the induced velocities is considered in detail, and formulas involving only an integration over the blade radius are found. The mathematical equivalence between these results and the conventional actuator disk representation of the propeller is demonstrated. Sample calculations of both the axial and radial velocity components for an arbitrary representative circulation distribution closely approximating the Goldstein optimum are presented. For the special case of a uniformly loaded propeller, expressions for the induced velocity components are given in simple closed form, and velocity profiles are compared with the representative results. Author

N64-21942 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE USE OF ANALOGUES IN THE STUDY OF TURBINE BLADE COOLING
J. Kunes and V. Ctvrtnik 31 Mar. 1964 38 p refs Transl. into ENGLISH from Strojnicky Casopis (CSSR), v. 12, no. 2, 1961 p 79–98
(FTD-TT-63-1104/1+2; AD-439598)

The present work describes a method in which an electrical potential analog is used to determine stabilized thermal fields in gas turbine blade profiles. A survey of various cooling systems used for gas turbine blades is presented. Methods of calculating heat exchange from the operating gas to the blade, and from the blade to the cooling agent are discussed. N.E.A.

N64-21948 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WING-FUSELAGE INTERFERENCE IN HIGH-ORDER CONICAL FLOW
Elie Carafoli and Dan Mateescu 11 Jun. 1963 24 p refs Transl. into ENGLISH from Studii si Cercetari de Mecanica Aplicata (Rumanian), v. 13, no. 2, Feb. 1962 p 275–294
(FTD-TT-63-391/1+2+3+4; AD-414714)

This paper proposes, by the use of high conical flows, a study of a wing-conical-fuselage system placed in supersonic flow. A general case is presented in which the distribution on the wing of the vertical velocity (resulting from the incidence or slope distribution) is different on various parts of the wing. N.E.A.

N64-21956 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THIN WING PROFILE WITH MINIMUM MEAN COEFFICIENT OF HEAT TRANSFER FOR A GIVEN LIFT
Ye. V. Bulygina, M. B. Polyakov, and Ya. S. Shcherbak 17 Oct. 1963 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (USSR), no. 2, 1961 p 17–25
(FTD-TT-63-804/1+2; AD-425611)

Equations are given for determining a wing profile with a minimum mean coefficient of heat transfer for a given lift. It is assumed that: (1) the profile is thin (the angles of inclination of the upper and lower surfaces are identical); (2) the upper and lower surfaces of the profile are heat-insulated; and (3) the boundary layer is either fully laminar or fully turbulent. I.v.L.

N64-22177 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PARACHUTE JUMPING COUNTER
I. Bondarenko and V. Chekunov 6 Jun. 1964 10 p Transl. into ENGLISH from Krylya Rodiny (USSR), no. 1, 1957 p 20–22
(FTD-TT-63-1120/1+2; AD-430022)

A small calculator for use by sportsmen parachute jumpers to assist them in accurate landing in a preselected area is described. The basic component of the counter is the graduated

circle. The circumference is divided into degrees for plotting the direction of the wind, and a sliding ruler plots the distances of the deviation of the parachute jumper in each 100-m layer using meteorological data of the wind direction and velocity. This device can also be used to compute the jumpers' general deviation from the point of abandoning the aircraft to the point of landing. Diagrams and concrete examples of the use of this device are given. M.P.G.

N64-22345 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WING FLUTTER AT NONLINEAR AERODYNAMIC FORCES
P. S. Landa and S. P. Strelkov 27 May 1963 13 p refs Transl. into ENGLISH from Izv. an SSSR, Otd. Tekhn. Nauk, (Mekhan. i Mashinostr.) (USSR), no. 5, 1962 p 111–117 (FTD-TT-63-201/1+2; AD-409947)

This report presents the results of a study on the bending torsional flutter of a wing with "Newton" lift, which were obtained with the aid of an electronic modeling machine type MN-7. The dependence of critical flight speed, at which flutter appears, upon the wing parameters and initial perturbation is described. I.v.L.

N64-22541 Therm, Inc., Ithaca, N.Y. Advanced Research Div.
A DETAILED NUMERICAL EVALUATION OF SHROUD PERFORMANCE FOR FINITE-BLADED DUCTED PROPELLERS
A. L. Kaskel, D. E. Ordway, G. R. Hough, and A. Ritter Dec. 1963 159 p refs
(Contract Nonr-2859(00))
(TAR-TR-639; AD-600577)

A simple procedure for calculating the detailed aerodynamic loading on the shroud of a finite-bladed ducted propeller in forward flight is presented. This procedure was designed for the evaluation of the several thousand configurations exactly represented by the tabulated values of the pertinent parameters, or reasonably approximated by them. In addition, configurations whose parameters fall somewhat in between or outside these values can be evaluated by suitable interpolation or extrapolation. The data were selected through liaison with propeller and aircraft manufacturers to encompass the current technology for ducted propeller design. As a result, it is possible to carry out a number of calculations by hand. Author

N64-22672* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF THE HYPERSONIC AERODYNAMIC CHARACTERISTICS OF SOME SIMPLE WINGED SHAPES IN AIR AND HELIUM
Thomas A. Blackstock and Charles L. Ladson Jun. 1964 42 p (NASA-TN-D-2328) OTS: $1.00

An investigation is made to study the simulation of high Mach number aerodynamics in air by the use of helium as a test medium. Force and moment characteristics for a series of wings of square and delta planform are presented at Mach numbers of 6.8 and 9.6 in air and 10.9 and 18.0 in helium for angles-of-attack up to 25°. The effects of leading-edge bluntness on all the wings and a vertical forward facing step on the square wing are also investigated. The experimental data are compared with theory, and normal-force coefficients are correlated by two methods. Author

04 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc., and specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; safety devices; and stability and control. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N64-21545 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE "AMUR" GLIDER
V. Zamyatin and V. Spivak 3 Feb. 1964 12 p Transl. into ENGLISH from Kryl'ya Rodiny (USSR), No. 9, 1962 p 17–19 (FTD-TT-63-1147/1+2; AD-433157)

The Amur glider is a light single-place glider-sailplane intended for the routine training of sportsmen. Because of its maneuverability it can be used in competitions. A detailed description of the Amur glider is presented. The flight tests of the glider have shown that it meets the specifications for such a vehicle. N.E.A.

N64-21564 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A PYRO-MECHANISM
G. A. Rokhlin and V. M. Zas'ko 26 Jul. 1963 9 p Transl. into ENGLISH of Russian Patent No. 129950, 26 Sep. 1959 p 1–2 (FTD-TT-61-366/1+2; AD-412940)

A firing mechanism for actuating parachutes to stabilize pilot ejection seats after ejection is described, incorporating a telescoping rod and a squib. The special features include two firing heads or squibs to insure better stabilization of the airborne ejection seat, by withdrawing the small parachute from the backwash zone. The mechanism is described in detail, and labeled diagrams are given D.E.W.

N64-21569 Naval Air Test Center, Patuxent River, Md.
CONTRACTOR'S AERODYNAMIC DEMONSTRATION (SPIN) OF THE YT-2B AIRPLANE Final Report
Richard S. Leighton and Hugh J. Campbell, Jr. 19 Feb. 1964 46 p refs
(NATC-TR-FT2122-19R-64; AD-431793)

Erect spins were demonstrated from normal, accelerated, and vertical entries. Wing-tip tanks were full, and Aero 6A rocket packs were carried. The erect spin and spin recovery characteristics of the YT-2B airplane with symmetric power are similar to those of the T-2A airplane. Inverted spins were not demonstrated. Author

N64-21589 Naval Ordnance Test Station, China Lake, Calif. Air-to-Air Weapons Div.
PROJECT HYDRA-IRIS
James E. Hurtt and Ray N. Francis Feb. 1964 18 p refs
(NOTS-TP-3391; AD-431792)

The Hydra–Iris vehicle is a two-stage system, employing a cluster of three Mk 6 Mod 0 Sparrow motors as a booster and an Iris sustainer that is capable of being launched from any spot on the ocean's surface. Two Hydra–Iris vehicles were with payloads designed to telemeter performance functions; to provide an insight into the feasibility of placing scientific payloads in a water-launched vehicle; and to supply telemetry data relating to the in-flight operation and reliability of two infrared radiometers and one ultraviolet radiometer that are so calibrated as to display a gradient or profile of the earth's terrestrial horizon. Two such vehicles were launched. Telemetry was received on the entire first flight. No trajectory was available, and only partial radar tracking was received on the second flight. Author

N64-21915 Kellett Aircraft Corp., Willow Grove, Pa.
APPLICATION OF A MECHANICAL GYROSCOPIC STABILIZER TO VTOL AIRCRAFT
William Koven et al Nov. 1963 141 p refs
(Contract NOw-62-0819-c)
(Rept.-220A90-2; AD-601170)

The application of mechanical gyroscopic stabilizers to VTOL aircraft was studied from design and flying quality considerations. Design studies of a single-degree-of-freedom gyroscopic stabilizer and a gyroscopic stabilizer bar were made to devise a reliable, lightweight, compact, and inexpensive mechanical stabilizer. The selection of parameters for the design of the stabilizers was made using existing analysis and stability derivatives for two tilt-wing VTOL aircraft. The stabilizer parameter evaluation procedure was established based on the available flying quality criteria. The results of this program show the single-degree-of-freedom stabilizer is less expensive, lighter weight, and is more compact than the stabilizer bar. The single-degree-of-freedom stabilizer will weigh 20 lb and will occupy 1/2 ft^3 of volume to provide attitude and rate stabilization about the pitch and roll axes of VTOL aircraft. Author

N64-21993 Bell Helicopter Co., Fort Worth, Tex.
GENERAL DEMONSTRATION FLIGHT TEST RESULTS FOR THE UH-1E, ASSAULT SUPPORT HELICOPTER, BuNo 62-151266, BELL S/N 6001
C. Leibensberger 5 Oct. 1963 212 p refs
(Contract AF 33(657)-9777)
(Rept.-204-099-171)

Included are results of the following tests: (1) structural demonstration—landplane and water landings, dives and pull-outs, flight vibration, external cargo hookup system; (2) aerodynamic demonstration—longitudinal control, dynamic stability, artificial disturbance, directional characteristics, autorotative characteristics, speed; (3) powerplant demonstration; and (4) equipment demonstration—accessory equipment, escape hatches, personnel equipment, electrical demonstration, avionics demonstration. P.V.E.

N64-22066* National Aeronautics and Space Administration. Flight Research Center, Edwards AFB, Calif.
THE X-15 PROJECT: RESULTS AND NEW RESEARCH
Thomas A. Toll and Jack Fischel Repr. from Astronautics and Aerospace Eng., Mar. 1964 p 20–28 refs
(NASA-RP-186)

A discussion of results achieved by and the overall value of the X-15 flight tests is presented. A review of the development of the flight program is given. This involved pilot selection, establishment of an operating base, and test-flight planning. The philosophy of the latter was to evaluate the characteristics of the vehicle in a noncritical environment before penetrating a possibly critical regime. The basic program concerned itself with verification of design assumptions, studies of structure and stability, and investigations of weightlessness problems. Concerning the aircraft itself, flight tests indicate that actual recorded temperatures at various locations were well within design parameters. Structural problems that have arisen are described and discussed. Controllability, piloting aids, and the landing behavior of the aircraft are described. Evaluation of pilot performance confirms his value as a sensor and recorder, and it is unlikely that a substitute can be found for his decision-making capability. Future plans for the X-15 program include extension to Mach-8 environment, studies of advanced ramjets, and tests and evaluations of materials and guidance concepts. IAA

N64-22132 Aeronautical Research Labs., Melbourne (Australia)
A LOW SPEED WIND TUNNEL DETERMINATION OF DYNAMIC LATERAL STABILITY DERIVATIVES FOR A 30° DELTA WING AIRCRAFT
M. D. Frost and P. A. Smith May 1963 33 p refs
(ARL/A-214)

Low-speed wind-tunnel results are presented for the following stability derivatives of a 30° delta wing aircraft: damping in yaw derivative ($n_r - n_{\dot{v}}$); yaw stiffness derivative n_v; and damping in roll derivative l'_p. The model was a 1/4-scale version of G.A.F. project K. The derivatives were determined by resonance and free oscillation techniques, and the effects of incidence, amplitude of oscillation, and reduced frequency parameter were considered. Additionally, some experiments were performed with a fin attached to the model. The derivatives depended in varying degrees on all the above quantities, and on Reynolds Number, but full investigations of the effect of the latter were not practicable. The largest variations in the derivatives were due to incidence changes. Author

N64-22188 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PILOT AND AIRCRAFT
J. G. Denison and R. N. Lopatin 31 Oct. 1963 264 p Transl. into ENGLISH of the Book "Letchik i Samolet" Moscow, Izd. Oborongiz, 1962 p 1-203
(FTD-TT-63-276/1+2; AD-426827)

This book discusses various links between the pilot and his aircraft, and the psychophysiological factors in humans when controlling present-day aircraft. Considered are the basic properties of an aircraft as a guided object and the various instruments and automatic devices as sources of information while flying an aircraft. Technical means of insuring the survival of aircraft crews during high-altitude and high-velocity flights as well as during space flights are discussed. N.E.A.

N64-22281 Minnesota U., Minneapolis
AERODYNAMIC CHARACTERISTICS OF THE PARAFOIL GLIDER AND OTHER GLIDING PARACHUTES
H. G. Heinrich, Thomas Nietz, and Harvey Lippa Wright-Patterson AFB, Ohio, Res. and Tech. Div., Apr. 1964 57 p refs
(Contract AF 33(616)-8310)
(RTD-TDR-63-4022; AD-600861)

A newly conceived gliding parachute, called the parafoil glider, and several existing glide parachutes have been examined with regard to their general stability, resulting stable angle-of-attack, and lift-to-drag ratio. The parafoil glider assumed stable angles-of-attack up to 50° against the vertical, which represents a lift-to-drag ratio of approximately 1.2. The

investigated existing parachutes had lift-to-drag ratios of less than unity. The tangential force coefficient of the parafoil glider amounts to approximately 1.5 at the position of the stable angle-of-attack. Author

N64-22295 United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft
STRUCTURAL DYNAMIC RESPONSE OF LARGE LOGISTIC V/STOL VEHICLES Technical Documentary Report, Jun. 1962–Feb. 1964
M. J. Rich, W. D. Jepson, A. C. Buffalano, and R. F. Stebbins Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Apr. 1964 203 p refs
(Contract AF 33(657)-8452)
(FDL-TDR-64-44; AD-601051)

Preliminary designs are evolved for five large logistic V/STOL configurations. Structural elastic characteristics and mass distributions are calculated. The structural dynamic response is investigated for ground landing, takeoff abort, maneuvers, gust penetration, and landing conditions. The results of these investigations are tabulated in a matrix showing the degree and relative criticalness for the conditions and the V/STOL configurations. The degree of criticalness is established as the ratio of the peak dynamic loading and/or stress to the values used in the configuration design structural study. The latter structural loads and/or stresses are evolved through the use of existing military specifications or normal design practices. The most critical structural design condition was the takeoff run of the ground-handling condition. The rigid and elastic body response from a 10-in., 1-cosine dip at lift-off speed is analyzed. Wing bending and torsional loads, nose and main gear loads, and center of gravity accelerations are calculated. Time histories of all loads and accelerations are shown for a dip wavelength-to-landing gear wheelbase ratio of 3.0. Energy-absorbing devices are evolved to reduce the criticalness of towing and to minimize the effects of dips on the aircraft structure. Author

N64-22629 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
REFUELING IN THE AIR
T. Krolikiewicz 19 Feb. 1963 11 p refs Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), v. 15, no. 9, 1961 p 36–43
(FTD-TT-62-1699/1+2; AD-400506)

Modern air refueling is based on the close approach of the tanker and the aircraft to be fueled. The refueling boom is automatically connected between the tanker to the other aircraft. The fuel is then poured tank-to-tank, ending with the disengagement of the connecting ends and separation of the aircraft. Refueling in the air increases the range of the aircraft and enables it to take on a greater load, the weight of which also depends on the fuel supply on board the aircraft. Refueling may take place before the tactical aircraft reaches enemy territory or during its return flight. It enables the shifting of air forces as well as action from much farther, less exposed airfields. J.L.D.

N64-22645 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WHAT ARE CUSHIONED CRAFT?
3 May 1963 10 p Transl. into ENGLISH from Skrzydl. Polska (Warsaw), no. 50, 1962 p 10–11
(FTD-TT-63-215/1; AD-409725)

A brief discussion is presented of the theory of ground effect machines, and some recent experimental types are described. P.V.E.

05 ASTRONOMY AND ASTROPHYSICS

Includes celestial mechanics; and radioastronomy. *For related information see*: 12 Geophysics, and 29 Space Sciences.

N64-21671 California Inst. of Tech., Pasadena Owens Valley Radio Observatory
THE SPECTRA OF NON-THERMAL RADIO SOURCES
Kenneth I. Kellermann 1964 33 p refs
(Contract Nonr-220(19))
(AD-434038)

The spectra of most nonthermal sources can be closely represented by a simple power law of the form $S \propto f^{\alpha}$, at least between 40 and 1,400 mc/s. The distribution of spectral indices for the sources away from the galactic plane is sharply peaked about a median value of −0.76, whereas the sources near the plane have a considerably wider dispersion of indices. The small-diameter, relatively weak sources tend to have relatively flat spectra. The most luminous sources, with high surface brightnesses, have normal spectra at decimeter wavelengths but are considerably flatter at meter wavelengths, suggesting that they are younger sources where equilibrium between the rate of injection of relativistic electrons and the rate of radiation loss was not yet established. The similarity of the spectra among the extragalactic sources and the surprising absence of any sources with very steep spectra are discussed, and it is suggested that these may be understood if intergalactic space provides a common, continuing source of relativistic particles for all extragalactic sources. The small differences in the observed spectral indices are explained as a result of variations in the rate at which the relativistic electrons are losing energy. Author

N64-21681 Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
CELESTIAL MECHANICS RESEARCH Final Report
G. Shapiro and E. W. Paul 28 Jan. 1964 30 p refs
(Contract AF 49(638)1002)
(AFOSR-64-0132; AD-434412)

A series of problems involving small perturbations to orbits was investigated by the Krylov–Bogoliuboff–Mitropolski (KBM) method. Several investigations of pure elliptic orbits were conducted. Kepler's equation was investigated from the function–theoretic standpoint. A simple derivation was obtained of some known and unknown sums involving Bessel coefficients. The stability of libration points is considered. The KBM method is tentatively applied to perturbations of a hyperbolic trajectory. A.W.

N64-21902* Esso Research and Engineering Co., Linden, N.J.
HYDROCARBONS IN TERRESTRIAL SAMPLES AND THE ORGUEIL METEORITE
Warren G. Meinschein Repr. from Space Sci. Rev. (Dordrecht), v. 2, 1963 p 653–679 refs
(Contract NASw-508)

Meteorites contain extraterrestrial carbonaceous materials. The Alais, Orgueil, Tonk, and Ivuna meteorites resemble in their carbon, free sulfur, and nonmetamorphosed mineral contents, densities, and general appearances certain organic-rich terrestrial sediments. Structural and isotopic determinations of carbon compounds in the Orgueil chondrite indicate that these compounds are primarily indigenous. Physically and chemically the benzene extractable carbonaceous materials from the

Orgueil and certain near-surface terrestrial sediments are similar. Mass spectrometric type analyses of the alkanes from an Orgueil fragment, terrestrial sediments and organisms are statistically indistinguishable at the 95% confidence level. Theoretical considerations and experimental data are presented, and these permit an assessment of the potential and reliability of hydrocarbons as biological indicators. Based on the production and preservation or organic substances in terrestrial environments, alkanes in the Alais, Orgueil, Tonk, and Ivuna (Type I) carbonaceous chondrites could retain the best evidence of organisms that may have lived on a parent body of meteorites. Author

N64-22220 Academy of Athens (Greece) Research and Computing Center
ANNUAL REPORTS OF THE ASTRONOMICAL INSTITUTES OF GREECE—1962
Greek Natl. Comm. for Astron., 1963 16 p

Annual reports of the following are presented: (1) Astronomical Institute, National Observatory of Athens; (2) Academy of Athens, Research and Computing Center; (3) Department of Astronomy, University of Athens; (4) Astronomical Department, University of Thessaloniki; and (5) Department of Astronomy, Technical University of Athens. These reports deal mainly with observations conducted, research programs, staff members, lectures, equipment and instrumentation, and publications. I.v.L.

N64-22234 Michigan U., Ann Arbor Radio Astronomy Observatory
SOLAR RADIO ASTRONOMY, VOLUME I
Mukul R. Kundu Mar. 1964 377 p
(Grant NSF G-19133)
(Rept.-64-4)

This report presents a review and coordinates the observations, interpretations, and associations of the sun's radio emissions, and shows the extent to which they contribute toward the basic understanding of solar physics and the sun–earth environment. Areas discussed are the following: (1) optical features of the active sun; (2) propagation and generation of radio waves in the solar atmosphere; (3) techniques of solar observations; (4) the quiet-sun radiation; (5) the slowly varying component; (6) bursts on centimeter wavelengths; and (7) bursts on decimeter wavelengths. N.E.A.

N64-22235 Michigan U., Ann Arbor Radio Astronomy Observatory
SOLAR RADIO ASTRONOMY, VOLUME II
Mukul R. Kundu Mar. 1964 485 p refs
(Grant NSF G-19133)
(Rept.-64-4)

This report presents a review and coordinates the observations, interpretations, and associations of the sun's radio emissions, and shows the extent to which these contribute toward the basic understanding of solar physics and the sun–earth environment. The following are discussed: (1) bursts on meter wavelengths—types III, U, and V; (2) bursts on meter wavelengths—type II; (3) type-IV radiation; (4) bursts on meter wavelengths—noise-storm radiation and type-I bursts; (5) solar radio and X-ray emission; (6) solar radio bursts, geomagnetic storms, and solar cosmic rays; (7) the active region and the flare event as a whole; (8) radar observations of the sun; and (9) satellite observations of solar bursts. N.E.A.

N64-22265* Yale U., New Haven, Conn.
PLANETARY INTERIORS; INTRODUCTORY REPORT
Rupert Wildt Repr. from "La Physique des Planetes", Les Cong. et Colloq. de l'Univ. de Liege, v. 24, 1962 p 15–28 refs Presented at the Intern. Colloq., Liege U., 9–11 Jul. 1962
(Grant NsG-312)

Planetary interiors are discussed by investigating how theories of planetary and stellar constitution are parallel, and how they differ. The subject is approached by looking into the mass–radius relation of planets; polymorphism of planets is considered; liquid phases and melting is mentioned; temperature gradient and radiative transfer is presented; and the shape of minor bodies is discussed. G.D.B.

N64-22472* Maryland U., College Park
EFFECTS OF STELLAR ENCOUNTERS ON PLANETARY MOTIONS
R. A. Lyttleton and Shin Yabushita [1960] 34 p refs
(Grant NsG-58-60)
(NASA-CR-56232) OTS: $3.60 ph

Changes in the semimajor axis, eccentricity, and inclination of a planetary orbit by an encounter with a passing star are calculated by the method of variation of elements. In order to estimate the cumulative effects of a long series of encounters, the velocity distribution of the stars is assumed to be Gaussian, and use is made of the central-limit theorem of probability. Explicit forms for the standard deviations of the distributions of the element changes are obtained in terms of the orbital elements of the planetary orbits, the average stellar velocity, the mean stellar density, the age of the system, and the lower bound of the impact parameter for which the analytical methods apply. Author

N64-22489* California U., La Jolla
OPTICAL ACTIVITY IN SAPONIFIED ORGANIC MATTER ISOLATED FROM THE INTERIOR OF THE ORGUEIL METEORITE
Bartholomew Nagy, Mary T. J. Murphy, Vincent E. Modzeleski, George Rouser, George Claus et al (City of Hope Med. Center) Repr. from Nature, v. 202, no. 4929, 18 Apr. 1964 p 228–233 refs
(Grants NsG-341; NsG-541)

Spectropolarimetric investigation of an optically active fraction was obtained by saponification of solvent extracts from a stone of the Orgueil carbonaceous meteorite. The examination was made because optical rotation is regarded as evidence of biological origin. The surface layer of the stone was removed with a high-speed, dental-type drill prior to extraction to insure the exclusion of possible contaminations from the meteorite surfaces. The saponified meteorite extracts showed a small but well-reproducible levorotation. Two saponified fractions obtained by the identical procedure from smaller fragments of two other stones of the Orgueil meteorite showed very similar levorotation. Identical fractions obtained from a recent alga (Pelagophycus porra), naphthenic acids in petroleum, and the Bruderheim noncarbonaceous meteorite were either slightly dextrorotatory or showed no optical activity at the same wavelengths. The chemical compositions of the optically active fractions of the meteorite were analyzed by IR, UV, and visible spectroscopy, and by thin-layer chromatography. The thin-layer chromatograms showed that the composition of the Orgueil meteorite extracts was wholly different from the composition of saponified fractions that can be isolated by identical procedures from recent biological matter. IAA

N64-22572* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
SUPERNOVAE, NEUTRINOS, AND NEUTRON STARS
Hong-Yee Chiu (Columbia U.) Washington, NASA, Jun. 1964 50 p refs
(NASA-TN-D-2112) OTS: $1.25

The final evolution of a presupernova star is reviewed. It is now believed that the supernova explosion of a star is first triggered by the collapse of its core, followed by the sudden release of gravitational energy or the sudden ignition of nuclear fuel in the envelope. Among the subjects discussed are the causes for stellar collapse, the static structures of white dwarfs and neutron stars, the dynamic collapse of oversized neutron stars, angular momentum and stellar collapse, and the observable features of neutron stars. Author

N64-22635 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COSMIC ASTRO OBSERVER
Zdenek Dobrichovsky 11 Mar. 1963 7 p Transl. into ENGLISH from Veda a Tech. Mladezi (Czech.), no. 9, 1962 p 305–307
(FTD-TT-62-1780/1+2; AD-400543)

A description is presented of a proposed orbiting observatory; it will have a 4-man crew that will remain inside the craft for 60-day periods. The observatory will circle the earth at an altitude of 800 km traveling at a velocity of 28,000 km/hr. The craft is divided into three basic structural and functional sections. The first is the head, which will contain the astronauts' beds, instrument panel, and other devices necessary for control and operation of the observatory. The head is detachable from the observatory and provided with an auxiliary rocket engine that will allow the crew to return to the earth in the event of an emergency. The second section is also the last stage of the carrier rocket. It initially carries rocket fuel, but after obtaining orbit the remaining fuel is pumped out and the space used for living and working quarters for the crew. The third section houses the instruments. The basic equipment includes two telescopes, a hyperbolic mirror, a parabolic mirror, and a cassegrain antenna. P.V.E.

06 AUXILIARY SYSTEMS

Includes fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters. *For primary propulsion systems see*: 27 Propulsion. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-21531 Harshaw Chemical Co., Cleveland, Ohio Crystal-Solid State Div.
INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS First Quarterly Technical Progress Report, 25 Nov. 1963–25 Feb. 1964
J. C. Schaefer, R. J. Humrick, and R. F. Belt Wright-Patterson AFB, Ohio, Aero Propulsion Lab., 6 Mar. 1964 55 p refs (Contract AF 33(615)-1248)
(AD-432192)

A rear-wall thin-film CdS-photovoltaic cell can be produced. A considerable effort would be needed to perfect this into an efficient and usable item; further work was abandoned. The principal vacuum evaporation parameters of substrate temperature and surface perfection were studied for CdS depositions. Thin films of CdS were prepared on Mo, Ta, Ti, Invar 36, quartz, Si, and CaF_2. Substrate temperatures ranged from 200° to 650° C. Ti shows excellent promise for reducing the total cell weight. Annealing, doping, and chemical reactions were studied to increase output efficiencies of production cells. Optical studies were performed on single crystals of CdS containing barrier layers. Different techniques of barrier application lead to characteristic optical constants of the surface layers. The efficiency decay of the photovoltaic cell in humid atmosphere can be retarded by SiO coatings. Preliminary results are encouraging for thin layers. Mathematical models describing photovoltaic cell behavior were considered. Limited success was achieved in explaining the short circuit current as a function of light intensity. Author

N64-21539* Space Technology Labs., Redondo Beach, Calif.
AN ADAPTIVE SYSTEM FOR LOAD RELIEF AND ACCURATE CONTROL OF LAUNCH VEHICLES
William J. Klenk N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(Contract NAS8-5051)
(AIAA Paper-64-239) AIAA: $0.50 members, $1.00 nonmembers

An adaptive load-relief control system for a Saturn-type vehicle, which significantly reduces aerodynamically induced structural loads without incurring excessive velocity dispersions, makes use of pendulous accelerometers to measure the angle between the total vehicle accelerator vector and the vehicle body. This measurement is used to fly the vehicle along the nominal trajectory. If unusually high values of wind velocity are encountered, the system causes the vehicle to turn into the wind to reduce the lateral structural loads. Peak structural loads can be reduced as much as 50% under those encountered when using conventional control techniques, and, since load relief is used only when required, velocity dispersions are held to a minimum. A.W.

N64-21568 Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
SOLAR THERMOELECTRIC GENERATOR SYSTEM CONCEPT AND FEASIBILITY STUDY Final Report, Feb. 1962 – Nov. 1963.
D. A. Naumer Feb. 1964 230 p refs
(Contract AF 33(657)-8089)
(RTD-TDR-63-4248; WAED-64-7E; AD-430127)

The feasibility of combining concentrated solar energy, thermal storage, and a thermoelectric generator as a power supply for space applications was proven. A nominal 14-w model, for operation in a 300-mi. earth orbit, was fabricated, tested using electric heat input in an altitude chamber, tested using natural solar energy input in an earth atmosphere and operated on a life test. A 90-min orbit with 55 min of energy input, or sunlight, and 35 min of darkness was simulated. The generator produced constant power (± 7%) for the full 90 min. Practical factors obtained from the feasibility model testing were incorporated into an analytical investigation of a complete system. A power-to-weight ratio of 2.4 is attainable at a power level of 70 w using a present day 5-ft-diam collector concentrator. The system efficiency (power output from the generator vs solar energy intercepted) of 4.3% was produced with a thermopile producing 13 w/lb. The collector concentrator provided 38% of the system weight. Author

N64-21668 Gulton Industries, Inc., Metuchen, N.J. Alkaline Battery Div.
LITHIUM-NICKEL HALIDE SECONDARY BATTERY INVESTIGATION 1st Quarterly Technical Progress Report
A. E. Lyall and H. N. Seiger 16 Mar. 1964 23 p
(Contract AF 33(615)-1266)
(AD-433616)

The compatibility of candidate materials for the construction of the battery and the preparation of suitable lithium and nickel chloride electrodes were investigated. Propylene carbonate and nitrobenzene are suitable as nonaqueous solvents in the presence of lithium metal. All other solvents tested either reacted with the metal or were affected by the lithium. A satisfactory lithium electrode has been produced by pasting an oil dispersion of lithium on an expanded metal grid. The addition of nonaqueous binders has facilitated this operation. These electrodes have a capacity of 1.24 amp-hr/in.^{2} The nickel chloride electrode has been prepared by impregnating a sintered nickel plaque with a solution of nickel chloride in a low surface tension solvent and by drying at 80° C and −20 in. of mercury pressure. Capacities of 0.31 amp-hr/in.^{2} of electrode have been produced. Author

N64-21685 Boeing Co., Seattle, Wash.
REACT INVESTIGATION OF GUIDANCE AND CONTROL SECTION S/N AAL0321 ST-107
A. Muhli Mar. 1964 14 p refs
(T2-3209-5; AD-433995)

The purpose of this test was to provide data for evaluation of Guidance and Control zero-time failures in the field by using the Rapid Evaluation and Correction Team and G&C Verification tapes, REACT break-out boxes, signal conditioners, and recording equipment. During the initial phase of testing with the REACT-G&C-computer program tape, a G&C error occurred during the alignment portion of start-up. This error was caused by a malfunction of the G&C platform and prevented the use of the REACT tape or the pulse code modulation telemetry ground station for obtaining data as originally intended. Three G&C verification tests were conducted, and recordings were made of the discrete outputs and their feedbacks during the 60 second-test portion. The following malfunctions were observed: (1) failure of the platform slew control; (2) failure of the thrust termination discrete during the discretes test; (3) random failure of the input test that checks filling of the computer; and (4) downstage no-go. Recorded voltages and resistance measurements showed variations in the reentry vehicle electrical-disconnect discrete line as compared with the other reentry vehicle discretes. Author

N64-21686 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) REACTION CONTROL SYSTEMS PROJECT Program Status Report, 23 Nov.–12 Dec. 1963
[1963] 17 p Prepared by Bell Aerosystems Co. for Boeing Co.
(Rept.-8233-933017; AD-434005)

The accessory package assembly was received, and system installation was completed. Design of the thrust chambers was completed with the exception of the drawing of the thrust chamber nozzle elements. The relief valve follower was redesigned, and tests were made of the tank assemblies. Work continued on the X-20 reaction control system design safety analysis. A malfunction analysis was completed, and a safety analysis review was conducted. System development tests were initiated. A weight and balance report is included. R.T.K.

N64-21690 Radio Corp. of America, Lancaster, Pa. Special Electronic Components Div.
THE DEVELOPMENT OF A LOW-TEMPERATURE VAPOR-FILLED THERMIONIC CONVERTER FOR NUCLEAR APPLICATIONS Summary Technical Report, 9 Oct. 1962 – 30 Sep. 1963
W. E. Harbaugh and R. J. Buzzard Jan. 1964 206 p
(Contract NObs-84823)
(AD-435885)

Following the successful operation of the RCA Developmental Type A-1197A converter in a nuclear reactor for more than 300 hours, the work in this phase was directed toward four principal objectives: improvement of the A-1197A design; the development of a higher power nuclear-fueled converter connected in series and parallel; and a continued investigation of material properties and converter fabrication techniques. Modifications to improve the performance and extend the life of the A-1197A converter were made on the basis of information obtained in performance and life tests and a detailed computer analysis. A new nuclear-fueled converter, Type A-1272, was designed; this converter produced more than 10 w/sq cm of emitter area during testing. As a result of the experiments with electrically heated converters, the basic principles governing the behavior of series- and parallel-connected converters were defined, mathematical expressions for these basic principles were developed, a method was devised for designing converter systems for use in a reactor, and computer programs were prepared that will predict the performance of these converter systems. Author

N64-21773 Calvin Coll., Grand Rapids, Mich.
SILVER MIGRATION AND TRANSPORT MECHANISM STUDIES IN SILVER OXIDE-ZINC BATTERIES Quarterly Technical Progress Report No. 1, 1 Dec. 1963–1 Mar. 1964
T. P. Dirkse [1964] 24 p refs
(Contract AF 33(615)-1236)
(AD-432346)

A survey was made of some of the factors that may affect the amount of silver lost by the electrode during the cycling of a silver-alkaline battery. Factors studied were: palladium additions to the silver electrode; presence of zinc oxide and other metallic compounds in the electrolyte; and the presence of surfactants in the electrolyte. The nature of the silver deposit on a cellophane separator was also investigated. Finally, the presence of colloidal matter in solutions of silver oxide in potassium hydroxide solutions was observed. Author

N64-21855 Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Electromechanical Div.
SNAP 2 POWER CONVERSION SYSTEM. MODEL 6 TWO-PHASE FLIGHT-PACKAGED SPEED CONTROL Topical Report 27
W. E. Dauterman Jun. 1964 103 p refs Prepared for Atomics International
(Contract AT(11-1)-GEN-8)
(ER-5908; NAA-SR-6319) AEC, Oak Ridge, Tenn.: $2.45

This report summarizes the packaging effort to achieve the Model 6 flight-speed control, including the heat-transfer analysis conducted prior to design of the Model 6 speed control, the first prototype flight package of the two-phase SNAP 2 control effort. Electrical and mechanical designs of the Model 6 speed control and fabrication procedures used during construction of the prototype unit are described. Results of temperature tests performed under atmospheric and vacuum

conditions substantiated, from a thermal standpoint, the validity of the heat rejection analysis. Results of qualification-level shock and vibration tests proved the structural design to be adequate and showed there is no need for complete potting of the controller components. Author

N64-21924 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL BITM AIR TURBINES
I. I. Kirillov, I. E. Gogolev et al 28 Jan. 1963 11 p refs Transl. into ENGLISH from Izv. Vyssh. Zavedeniy. Energetika, (Minsk), no. 5, 1962 p 119–122
(FTD-TT-62-1742/1+2+4; AD-298221)

Models used for aerodynamic investigation of stages of steam and gas turbines at low velocities are discussed. In particular, new experimental models are described that are in operation or in the manufacturing stage of development. The new models are used at higher rotational velocities than presently existing models. P.V.E.

N64-21952 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATION OF THE BASIC DIMENSIONS OF A SINGLE-STAGE CENTRIPETAL TURBINE
M. V. Nosov 30 Jul. 1963 91 p refs Transl. into ENGLISH from the Russian Book "Raschet Osnovnykh Razmerov Odnostupenchatoy Tsentrostremitel'noy turbiny" Moscow, Gos. Nauchno-Tekhn. Izd., 1961 p 3–83
(FTD-TT-63-682/1+2+4; AD-422098)

The calculation formulas for constructing the external characteristics, and the order for calculating the basic dimension of a single-stage centripetal turbine are presented. Preliminary construction of the external characteristics gives sufficient information for selecting the calculation regime for operation of the turbine and for estimating the magnitude of a change in its parameters when the regime is other than that calculated. The text is divided into the following sections: (1) data for designing a turbine stage; (2) selection of the basic design parameters and ratios; (3) basic energy equations for a turbine stage; (4) sequence of calculating a turbine stage; and (5) approximate calculations of a single-stage radial centripetal turbine. R.T.K.

N64-21969 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SELF-ALIGNMENT AND BALANCING OF COAXIAL ROTORS
Ye. G. Berger and A. S. Kal'zon 26 Mar. 1964 7 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Mat., Mekhan. i Astron. (Leningrad), no. 3, 1963 p 119–121
(FTD-TT-64-75/1+2; AD-600487)

The problem of alignment and damping of vibrations in a pair of coaxial rotors with different angular velocities is discussed. This problem is of particular interest in view of the widespread use of gas-turbine engines to drive such rotors. Small oscillations of coaxial rigid rotors with elastic fastenings are treated mathematically, and conditions of self-alignment are derived and presented. D.E.W.

N64-22003 Atomics International, Conoga Park, Calif.
HNPF CONTROL SYSTEM RESPONSE DURING TRANSIENT CONDITIONS
P. F. Shaw 15 Jun. 1964 28 p ref
(Contract AT(11-1)-GEN-8)
(NAA-SR-9584) OTS: $0.75

This report documents the results of power ramps imposed on the Hallam Nuclear Power Facility (HNPF). Analysis and evaluation of the data acquired during these tests verify the adequacy of performance of the HNPF plant control system. It was demonstrated, within the conditions of the test, that the HNPF is capable of automatically following station load change rates in excess of the 5 mwe/min test objective. Data from the ramp tests and other pertinent information are included. Author

N64-22009 Aerojet-General Corp., Sacramento, Calif.
VaPAK, A SIMPLE SELF-PRESSURIZATION SYSTEM
5 Jun. 1964 72 p refs
(Rept.-8290-5S)

VāPak is a lightweight vapor pressurization system that offers a potential improvement in flexibility over any of the liquid propulsion systems. In principle, it is similar to that of a self-discharging insecticide or paint can. The propellant is expelled by its own vapor without a significant change in discharge pressure. No high-pressure gas bottles, regulators, or pressurization cartridges are required; in fact, no components or devices whatsoever must function, once liquid flow from the VāPak tanks is initiated. In appropriate applications, this vapor pressurization concept results in a liquid rocket with system simplicity exceeding that of a solid rocket, but retaining the performance and controllability obtained with liquid propellants. The feasibility of expelling various earth storable and cryogenic propellants by VāPak have been successfully demonstrated. Long duration storage and rocket engine tests verified the instant readiness and combustion characteristics of saturated propellants. Throttling tests indicated a wide thrust range capability with a fixed-area injector. I.v.L.

N64-22074 Princeton U., N.J. Plasma Physics Lab.
A SIX MEGAWATT R. F. POWER GENERATOR FOR PLASMA HEATING
Allan Deitz Jan. 1964 13 p
(Contract AT(30-1)-1238)
(MATT-260)

This report deals with the design and construction of a 6-mw pulsed radiofrequency generator to be used for ion cyclotron resonance heating of a plasma. The electronic equipment described in this paper is presently in use on the Model C-stellarator of the Plasma Physics Laboratory, Princeton University. The theory of Ion Cyclotron Resonance Heating is not within the scope of this report. Author

N64-22088 Naval Ordnance Lab., Corona, Calif.
SUPPLEMENT TO SIXTH SYMPOSIUM ON AMMONIA BATTERIES
15 Mar. 1964 19 p refs Symp. held at California U., Berkeley, 30–31 Jan. 1964
(NOLC-597, Suppl.; AD-434022)

Two papers dealing with ammonia systems are presented. The first is concerned with the development of hot, dry, pressed silver chloride cathodes for liquid-ammonia systems, and the second, concerned with organic cathode materials, presents a review of the general electrochemical behavior of organic materials as applied to batteries with aqueous electrolytes. P.V.E.

N64-22098 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
PERMEATION OF HYDROGEN THROUGH METALS IN THERMIONIC-CONVERTER APPLICATIONS
John E. Creedon Jan. 1964 20 p refs
(USAELRDL-2431; AD-434873)

Permeation of hydrogen through the emitter surface of a thermionic converter is discussed. Approaches to eliminating a pressure buildup inside the converter are examined, and

it is shown that a nickel window could be used to maintain a relatively low partial pressure of hydrogen. Author

N64-22119 Tyco Labs., Inc., Waltham, Mass.
ELECTROCHEMISTRY OF FUEL CELL ELECTRODES. HYDROGEN EVOLUTION AT A DROPPING INDIUM AMALGAM ELECTRODE
James N. Butler and A. C. Makrides Feb. 1964 28 p refs
(Contract Nonr-3765(00); ARPA Order 302-62)
(TM-10; AD-433655)

The rate of the hydrogen evolution reaction was studied at dropping indium amalgam electrodes containing 0% to 65% indium, in 0.1 molar $HClO_4$ at 25°C. The potential of zero charge was also determined for the same series of amalgams, and the Frumkin correction for the potential drop across the diffuse double layer was used to obtain the exchange current and transfer coefficient for each of the amalgams. The exchange current increased by approximately a factor of 10 as the composition was varied from 0% to 65% In. The transfer coefficient was 0.50 independent of composition within experimental error. The current at the zero-charge potential, which gave a measure of the free energy of activation for the discharge reaction, increased by a factor of 10^4 as the composition was changed for 0% to 65% In. The corresponding decrease in the free energy of activation was approximately 5 kcal, and was attributed primarily to a change in work function. Author

N64-22192* Westinghouse Electric Corp., Lima, Ohio Aerospace Electrical Div.
PARALLEL INVERTER AND CONVERTER OPERATION AND IMPROVEMENTS IN TRANSFORMERS Third Quarterly Report, 28 Dec. 1963–27 Mar. 1964
G. W. Ernsberger, H. R. Howell, and A. R. Baker [1964] 153 p
(Contract NAS3-2792)
(NASA-CR-54074) OTS: $11.50 ph

The objectives of this contract were as follows: (1) to improve inverter transformer weight and efficiency through the application of field-annealed doubly oriented silicon-steel; and (2) to improve inverter and converter reliability and power capability through the development of means for parallel operation of static inverters and converters. These objectives have been met and verified through the testing and evaluation of two transformer models and the successful paralleling of two 750-watt static inverter and converter models. The 0.006-in.-thick doubly oriented silicon–steel (Cubex) used in one static-inverter output transformer had 33% lower core loss at 13-kg flux density than the 0.011-in.-thick singly oriented silicon–steel (Hipersil) used in the second transformer model. With the same amount of steel in both transformers, the static-inverter full-load efficiency increased approximately 2% when operated with the Cubex steel transformer core. Author

N64-22201 Radio Corp. of America, Lancaster, Pa. Special Electronic Components Div.
RESEARCH STUDIES ON THERMIONIC CONVERTERS, EMITTER SHELL PHASE Second Quarterly Technical Report, 1 Oct.–31 Dec. 1963
G. Y. Eastman Jan. 1964 35 p refs
(Contract DA-36-039-AMC-03197(E))
(Rept.-2; AD-434908)

Sample materials were evaluated for permeation. The mathematics of the investigation were reviewed and refined to assure accurate analyses. Testing techniques were developed. A control sample of molybdenum was evaluated to verify permeation rates of other investigators. The sensitivity of the equipment was established at better than 10^{-12} liter mm/cm^2 sec. Hydrogen permeation rates for four sample materials were determined, and, although hydrogen permeation does take place, it is at levels that can be controlled by known sorption and gettering processes. A converter for use with fossil fuel was developed employing materials compatible with cesium and designed to permit the substitution of the emitter barrier with material determined optimum by the evaluation program. Author

N64-22261 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report, 1–28 Feb. 1963
A. W. Mills et al 10 Mar. 1963 183 p Prepared by Sundstrand Aviation-Denver for Boeing Co.
(DSR-17; AD-433825)

This report on the X-20 (Dyna-Soar) accessory-power-unit development covers the following: prime mover, gearbox and lubrication system, combustor, hydraulic pump, regenerator and preheater, control valves, electronic controller, accessories, system analysis, and reliability. J.R.C.

N64-22263 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report, 1–30 Apr. 1963
A. W. Mills et al 10 May 1963 192 p Prepared by Sundstrand Aviation-Denver for Boeing Co. For abstract see N64-22261 15-06
(DSR-19; AD-433864)

N64-22291 North American Aviation, Inc., Los Angeles, Calif.
INVESTIGATION OF POWER CONVERSION AND GENERATION TECHNIQUES Technical Documentary Report, 15 Apr. 1963 – 15 Feb. 1964
J. J. Pierro, J. E. Phillips, E. Cima, L. Luera, S. J. Nalbandian et al Wright-Patterson AFB, Ohio, Res. and Technol. Div., 15 May 1964 265 p refs
(Contract AF 33(657)-11049)
(APL-TDR-64-53; AD-600833)

The conversion unit is to supply high-frequency electric power to accelerate plasmas in an electric propulsion engine. Various conversion and power generation techniques were reviewed in the early part of the study before approaches and concepts were established. In addition to the converter concepts, an additional investigation of high-frequency power generation was performed. After the preliminary investigation, an analysis of possible approaches for conversion of 60 of SNAP 8 type of power and 300 of SPUR type of power was made and conceptual designs established. Three converter techniques in addition to a high-frequency generator concept were evaluated; namely, a motor-generator unit, a static transistor unit, and a static tube unit. Parametric data were derived and are included in this report to show component losses, size, and weight. Problem areas under each conversion technique were outlined and areas for future applied research recommended. Author

N64-22324 Aerospace Corp., El Segundo, Calif. Electronics Div.
ELECTRONICS PROGRAM. SATELLITE ATTITUDE CONTROL SYSTEM EXPERIMENTS Semiannual Technical Report, 1 Jul.–31 Dec. 1963
D. J. Griep 15 May 1964 35 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-86; TDR-269(4250-32)-2; Formerly ATN-64 (4540-50)-2; AD-600719)

Progress was achieved in the determination of the pulsed performance of low thrust, cold gas, mass expulsion systems. The results obtained from these experiments required the revision of the analytical model describing the pulse performance of cold gas pneumatic systems. A satellite attitude control system utilizing a mercury fluid flywheel is currently being mechanized on the single-axis vehicle simulator. A digital logic controller was evaluated using the single-axis vehicle simulator. A G.E. Mod II horizon sensor noise evaluation has been performed. The power spectral density of the sensor noise was obtained. Author

N64-22335 Thompson Ramo Wooldridge, Inc., Cleveland, Ohio TRW Electromechanical Div.
APPLIED RESEARCH PROGRAM FOR BINARY RANKINE CYCLE ENERGY CONVERSION Final Technical Report, Mar. 1962–Mar. 1963
C. H. Allen, S. S. Carlton, J. G. Lenhart, and R. R. Reimer Wright-Patterson AFB, Ohio, Aero-Propulsion Lab., Apr. 1964 166 p refs
(Contract AF 33(657)-8101)
(ER-5925; APL-TDR-64-5; AD-600320)

The combined collector–radiator studies considered the thermal and structural stability of the assembly and devised and developed techniques for its fabrication. The assembly consists of a stretch-formed aluminum sheet to form the collector surface with tubes joined to the back side forming a conventional fin-tube radiator. The low-temperature working fluid selected is the aromatic hydrocarbon, ortho-xylene. The studies definitely showed the practical feasibility of applying the binary Rankine cycle concept to space power conversion applications and indicated that it can provide a positive improvement in system weight and performance compared to competitive systems. Low-temperature binary systems using mercury and a hydrocarbon were found superior to high-temperature systems using an alkali metal and mercury as the working fluids. In the power range of interest, from 5 to 50 kw, system specific weights of 86 to 51 pounds per kilowatt were estimated. Excellent optical quality can be obtained from the combined collector–radiator and the geometric profile can be controlled against thermal distortion. Author

N64-22358 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATIONS AND PHYSICAL DESIGNS FOR AIRCRAFT HYDRAULIC DEVICES
T. M. Bashta 11 Oct. 1963 775 p refs Transl. into ENGLISH of the book "Raschety i Konstruktsii Samoletnykh Gidravlicheskikh Ustroystv" Moscow, Gos. Nauchno-Tekhn. Izd., 1961 p 3–474
(FTD-TT-63-939/1+2; AD-424560)

In the discussion of synthesis techniques, the most important factors influencing the performance of the assembly and the flow of the working fluid in the systems are considered. Also considered are hydraulic motors and pumps (piston, rotary, and gear types), hydraulic drives, power cylinders, distributor and safety devices, flow regulators, remote-control and followup devices, and sealing devices. Author

N64-22370 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report, 1–31 May 1963
A. W. Mills et al 10 Jun. 1963 217 p Prepared by Sundstrand Aviation-Denver for Boeing Co.
(DSR-20; AD-433994)

The status is reported of the following subsystems: prime mover, gearbox and lubrication system, combustor, hydraulic pump, regenerator and preheater, control valves, electronic controller, and accessories. System analysis, reliability, and unit build and test status are also included. R.T.K.

N64-22384 General Electric Co., Schenectady, N.Y. Research Lab.
THERMIONIC CONVERTER SURFACE CONDITIONS
V. C. Wilson and J. Lawrence Wright-Patterson AFB, Ohio, APL, Jun. 1964 63 p refs
(Contract AF 33(657)-10132)
(APL-TDR-64-63; AD-601327)

Four thermionic converters were fabricated and tested. The first had a niobium carbide emitter and a molybdenum collector, and the second had an oxygen-treated tantalum emitter and a molybdenum collector. Experience gained testing the first two converters showed the desirability of modifying the converter design. One of the new-design converters had a tungsten emitter and nickel collector. The other had a rhenium emitter and nickel collector. Both had 0.005-in. separation between the emitter and collector. Output power density, electron cooling, input power, and calculated useful efficiency for these converters are discussed. N.E.A.

N64-22416* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
THE BRAYTON CYCLE FOR SPACE POWER
Warner L. Stewart, Arthur J. Glassman, and Richard P. Krebs N.Y., SAE [1963] 10 p refs Presented at the Natl. Aeron. and Space Eng. and Mfg. Meeting, Los Angeles, 23–27 Sep. 1963
(SAE Paper-741A)

This paper reviews the basic features of the Brayton cycle and discusses the selection of such cycle parameters as working fluid, pressure, and temperature. System performance, weight, and reliability characteristics are then considered in order to determine the suitability of this type of system for the intended space applications. It is shown that the Brayton cycle can be considered suitable for low-power solar and intermediate-power nuclear applications where low specific weight is not a critical requirement. To achieve the low specific weights required for electrical propulsion mission, turbine-inlet temperatures in the 3,000° R region at power levels in the 500- to 1,000-kw range appear to be necessary. Author

N64-22424* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio New Product Research Dept.
60 INCH STRETCH FORMED ALUMINUM SOLAR CONCENTRATOR Final Report, 24 Jun.–28 Oct. 1963
11 Nov. 1963 59 p refs
(Contract NAS1-3216)
(NASA-CR-56469; ER-5638) OTS: $5.60 ph

All of the tasks in the development of a 60-in. solar concentrator were completed. Of particular importance in the improvement of the concentrator was the 4-to-1 reduction of surface-slope errors due to stretch forming. This improvement is basic to the number of available power-conversion systems with which this concentrator concept may be used. The stretch forming, spray coating, and optical-inspection equipment modifications are discussed in detail. The stretch-formed concentrator was improved sufficiently to be used with thermionic-conversion systems. R.T.K.

N64-22429 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report, 1–31 Jan. 1963
A. W. Mills et al 15 Feb. 1963 175 p Prepared by Sundstrand Aviation-Denver for Boeing Co.
(DSR-16; AD-434026)

Progress in subsystem development covered the following areas; (1) prime mover—analysis of two-stage and three-stage reentry impulse turbines; (2) gearbox, lubrication system, and cold plate; (3) combustor; (4) hydraulic pump; (5) regenerator and preheater; (6) control valves; (7) electronic controller for speed control and exhaust-temperature control; (8) accessories—tach generator, magnetic pickup, elapsed-time indicator, temperature probes; and (9) subsystem testing. System analysis, reliability, and test status are also covered. E.K.R.

N64-22430 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report 1–31 Mar. 1963
A. W. Mills et al 10 Apr. 1963 308 p Prepared by Sundstrand Aviation-Denver for Boeing Co.
(DSR-18; AD-434027)

The initial testing of accessory power unit subsystems was completed revealing problem areas in instrumentation but not necessitating repetition of the tests. System analysis was concerned with possible modifications in two problem areas, programed start and exhaust temperature control. The reliability program emphasized failure mode analysis of the Parker control valve, in-house manufactured components, process monitoring, and hardware contamination. Life tests on assembled APU's are being conducted for combustor catalyst and turbine wheel testing. A study of fluid film bearings to replace rolling contact bearings was made to improve reliability without loss of performance. D.S.G.

N64-22513 General Electric Co., Pleasanton, Calif. Vallecitos Atomic Lab.
NAVY THERMIONIC DIODE PROGRAM Semi-Annual Technical Documentary Report
21 Dec. 1963 47 p
(Contract NObs-88621; ARPA Order 219)
(GEST-2031; AD-438894)

This report presents a description of experimental and analytical work in nuclear thermionics. Discussed are the design of plasma thermionic diodes, diode fabrication, and diode processing. N.E.A.

N64-22521 Union Carbide Corp., Parma, Ohio Parma Research Center
THIN FUEL CELL ELECTRODES
K. V. Kordesch [1964] 39 p refs
(Contract DA-36-039-AMC-02314(E))
(QR-3; AD-600951)

Results of pressurization, influence of carbon dioxide from the air, behavior of electrodes under abuse-testing conditions, such as gas reversal, shorting, electrolyte loss, and at freezing temperatures, are given. More operational life data on larger cells are presented. To round out the testing program, performance in immobilized caustic electrolytes has been checked. Some modifications in the nickel backing were made in an effort to make the electrodes more rugged and better suited for larger batteries. Author

N64-22556 Aerospace Corp., El Segundo, Calif.
SPACE VEHICLE POWER SOURCES HANDBOOK
Rex A. Barney 21 May 1964 119 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-8; TDR-269(4710-17)-2; AD-441574)

Future Air Force missions are analyzed to obtain space vehicle power requirements, and power systems are suggested for these projected programs. Basic principles of operation of energy conversion devices such as fuel cells and solar cells are briefly explained. Energy conversion systems are categorized by availability or development status, i.e., currently available, under study, or advanced (early stage of applied research) concepts. A description of each device is given, along with the specific power, power level, and duration that might be expected. Power transmission, energy storage, radiators, and turbines are also included as separate items of discussion. An extensive bibliography is provided. Author

N64-22639 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DESIGN OF THERMOELECTRONIC 300-KW GENERATOR
15 Feb. 1963 4 p Transl. into ENGLISH from Przegl. Tech. (Warsaw), no. 27, 5 Jul. 1961 p 11
(FTD-TT-62-1824/1; AD-401363)

An experimental laboratory-type thermoelectronic generator is described. The generator consists of an emitter, or cathode, and a collector. It is housed in an airtight vacuum vessel, or a vessel filled with an ionized gas, such as cesium vapor. The gas neutralizes the volume charges appearing as a result of electron emission from the cathode. A two-stage thermoelectronic generator, housed in an airtight titanium shield, was built for demonstration purposes. The results of the demonstrations are given. Thermoelectronic generators are to be used in space vehicles to produce electrical energy from nuclear energy for electrical and electronic installations of the space vehicle. N.E.A.

N64-22650 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HOMOPOLAR DC MOTOR FOR QUITE HIGH VOLTAGE, ESPECIALLY A GENERATOR OR HIGH CAPACITY MOTOR
Stefan Janiczek 9 Jul. 1963 10 p Transl. into ENGLISH from Polish Patent No. 44923, 21 Sep. 1961 p 1–4
(FTD-TT-63-487/1+2; AD-419228)

A collectorless d.c. motor is described. The armature for the motor is made up of single turn windings with only one active side. The windings are situated concentrically, and a magnetic shield, cooled to the state of superconductivity, is placed between them in order to protect the internal conductor (the inactive side of the windings) from the effect of the magnetic field. The motor is cooled by thermoelectric means and is operated in a vacuum. P.V.E.

N64-22696 Mallory (P.R.) and Co., Inc., Indianapolis, Ind.
MERCURY CELL BATTERY INVESTIGATION Final Report, 15 Dec. 1961–15 Dec. 1962
J. M. Booe and R. E. Ralston Wright-Patterson AFB, Ohio. ASD, Jan. 1963 67 p
(Contract AF 33(657)-7706)
(ASD-TDR-62-1112; AD-296906)

The rechargeable electrochemical system zinc–potassium hydroxide–mercuric oxide silver has been investigated from the viewpoint of aerospace requirements. Individual study phases were used to evaluate cell components, both separately and as operating cells. Zinc anodes containing high percentages of mercury were discharged with efficiencies over 90% at rates up to 2,000 ma/in.^{2} under uninhibited conditions. Reliable apparatus was developed to determine the gas volume generated during chemical reactivity rate studies between high mercury content anodes and electrolytes. A comprehensive study of separator materials was made. Electrical resistance, tensile strength, and metal ion content values were obtained on commercially available and specially prepared materials after various exposure periods. Positive electrode densification experienced during cycle testing appears to be related to cycle

depth. Automatic cycle testing equipment was used to accumulate data on the 2-hour simulated orbit cycle. Author

07 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis. *For related information see*: 18 Materials, Metallic; 19 Materials, Nonmetallic; and 26 Propellants and Combustion.

N64-21577 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
STUDIES IN THE FIELD OF COORDINATION CHAIN POLYMERS. VII: COORDINATION POLYMERS BASED ON QUINIZARIN AND 4,4'-BIS-(ACETOACETYL)-DIPHENYL ETHER
V. V. Korshak, S. V. Vinogradova, and D. T. Morozova 22 Apr. 1964 15 p refs Trans. into ENGLISH from Vysokomol. Soyedineniya (USSR), v. 3, no. 10, 1961 p 1500–1508 refs
(RSIC-168; AD-600085)

Polymetallic derivatives based on quinizarin or quinizarin and 4,4'-bis-(acetoacetyl)-phenyl ether and the metals zinc, copper, manganese, nickel, cobalt, magnesium, calcium, cadmium, and beryllium were synthesized and investigated. Author

N64-21585 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
STUDIES ON ISONITROSOKETONES
S. Cusmano and T. Tiberio 22 Apr. 1964 14 p refs Transl. into ENGLISH from Gazz. Chim. Ital. (Rome), v. 81, 1951 p 106–116
(RSIC-167; AD-600180)

Discussed is a study of the behavior of isonitrosoacetone toward hydroxylamine in alkaline or acid media to contribute to the knowledge of the structure of condensation products obtained from isonitrosoketones when exposed to the effect of mineral acids or hydrosylamine hydrochloride. Isonitrosoacetone was subjected to the action of hydroxylamine in a strongly alkaline medium, and to the action of hydrochloric acid. The isonitroso compound was converted in the first case into aminomethylfurazan in an excellent yield, and in the second case into a condensation product whose structure is under investigation and whose brutto formula is $C_6H_9N_3O_3$. Author

N64-21590 National Canners Assn., Washington, D.C.
APPLICATION OF RADIOCHEMISTRY TECHNIQUES IN FOOD PROCESSING RESEARCH: RADIOISOTOPIC TRACER TECHNIQUES IN EVALUATION AND IMPROVEMENT OF INDUSTRY PRACTICES FOR REMOVAL OF PESTICIDE RESIDUES FROM FOODS Annual Report
Walter A. Mercer ed. Feb. 1963 94 p refs
(Contract AT(04-3)-296)
(SAN-1022) OTS: $2.00

The methods of fly bioassay and paper chromatography were emphasized because of their availability to all food processors, their simplicity, and low cost. Studies of the extraction of radioactive pesticides from tomato pomace demonstrated the necessity of multiple extractions for good recovery. Evaluation of four methods for cleanup of pesticide residues resulted in establishing the superior performance of Florisil and silica gel–alumina columns. These results form a basis for the development of a manual of methods for pesticide analysis in the food processing industry. A preliminary survey of the extent of pesticide residue removal during food processing was conducted using neutron activation analysis. Detergent washing in removing pesticide residues from tomatoes was found effective. D.S.G.

N64-21609 Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center
THE MASS SPECTRA AND CORRELATIONS WITH STRUCTURE FOR 23 ALKYLTHIOPHENES
Norman G. Foster, D. E. Hirsch, R. F. Kendall, and B. H. Eccleston 1964 42 p refs Presented in part at the Meeting of the Am. Soc. for Testing and Mater. E-14 Comm. on Mass Spectrometry, Atlantic City, 30 Jun. 1960
(RI-6433)

The mass spectra of 23 alkylthiophenes are presented, including 21 that were not previously reported. Correlations between mass spectra and the structure of the thiophene homologs are discussed. Comparisons with, and corroboration of, earlier workers' correlations and predictions are made. Several additional correlations are reported to enable the spectroscopist to identify the substituents on alkyl-substituted thiophenes, and the relationship of the monosubstituted and 2,5-disubstituted alkylthiophenes is discussed in detail. Author

N64-21610 Bureau of Mines, Albany, Ore. Albany Metallurgy Research Center
METHODS USED IN PREPARING BORON
D. Z. Hobbs, T. T. Campbell, and F. E. Block Aug. 1963 20 p refs
(BM-RI-6456)

Several methods were investigated for the preparation of high-purity elemental boron in an attempt to develop a feasible process for producing boron on a large scale. The metal was prepared by metering boron trichloride gas into a crucible containing molten metal reductants, removing reaction byproducts by acid and aqueous leaching. Magnesium and sodium were tested as reductants, but best results were achieved using lithium or zinc as reductants. Contaminants originating from the materials of construction were the chief impurities in boron made by this method. Impurities ranged from 0.5% to 5.0%. Impure boron (85% to 90%) was also prepared by the magnesium reduction of boron trioxide in a thermite-type reaction. This product contained magnesium as the chief contaminant; impure boron made in this way can be upgraded by fusing with potassium fluoborate or potassium acid fluoride. After acid leaching the fusion cake, a product containing 95% to 97% boron was obtained. Analytical techniques for accurate determination of impurities in elemental boron are a major problem, requiring solution before a valid comparison can be made of the quality of boron prepared by these various methods. Author

N64-21617 Oak Ridge National Lab., Tenn.
TRANSURANIUM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING NOVEMBER 30, 1963
W. D. Burch Comp. May 1964 80 p refs
(Contract W-7405-ENG-26)
(ORNL-3597) OTS: $2.00

Reported is the research, development, and design work directed toward the eventual operation of the Transuranium Processing Plan (TRU) for the separation and recovery of gram quantities of the very heavy actinide elements. Process development includes the following: (1) Tramex process development—acid control in Tramex feed, evaluation of purified Alamine 336, and Tramex safety; (2) Talspeak—separation of trivalent actinides form lanthanides by organophosphorus extraction from aminopolyacetic acid solutions; (3) americium–curium separations at high-alpha-activity levels by precipitation and ion exchange; (4) preparation of curium amalgam; and (5)

preparation of oxides for high-flux isotope reactor (HFIR) targets. E.K.R.

N64-21656 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OBTAINING ELEMENTAL BORON BY HYDROGEN REDUCTION OF BORON HALIDES
L. A. Nisel'son, I. V. Petrusevich, F. I. Shamray, and T. F. Fedorov 17 Jan. 1963 11 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 35, no. 5, 1962 p 984–989
(FTD-TT-62-1638/1+2+4; AD-298238)

Four older methods of preparing relatively pure boron by the hydrogen reduction of boron halides are described. A new method that starts with purified boron halide is described, including steps for purifying the hydrogen and conditions and operations throughout the process. The kinetics of hydrogen reduction of boron halides on a heated surface, the regions of formation of various modifications of boron as a function of temperature, and the ratio H_2:BBr_3 were determined. D.E.W.

N64-21736 Hanford Atomic Products Operation, Richland, Wash. Chemical Lab.
SOLVENT EXTRACTION OF STRONTIUM, CERIUM, AND RARE EARTHS WITH D2EHPA. PART 2: PILOT PLANT STUDIES
G. L. Richardson Feb. 1964 45 p refs
(Contract AT(45-1)-1350)
(HW-79762, Pt. 2) OTS: $1.25.

A four-column di-2-ethylhexyl phosphoric acid (D2EHPA) process has been developed for the simultaneous extraction of strontium and rare earths from Purex acid waste (PAW). Pulse columns of the same general type as those used in the Purex process were successfully used as the contractors. The clarified PAW, with added citric acid or tartaric acid to complex iron, aluminum, chromium, nickel, and most of the unwanted fission products, is adjusted to pH 4.7 and is contacted at about 50° C with 0.2 M D2EHPA-0.2 M tributyl phosphate–hydrocarbon diluent in the first column. The solvent, containing essentially only strontium, rare earths, calcium, and sodium, is passed through a second column where formic acid selectively removes sodium and other weakly extracted cations. Strontium is stripped in a third column with dilute HNO_3 at a controlled pH; and the rare earths, together with most of the calcium, are stripped in a fourth column with more concentrated HNO_3. The spent solvent is washed, at an elevated temperature, with a basic solution such as dilute NaOH to remove yttrium and small amounts of "irreversibly" extracted iron, aluminum, and zirconium. I.v.L.

N64-21774 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
EFFECT OF RECIRCULATION OF DISSOLVER EFFLUENT ON THE CONTINUOUS DISSOLUTION OF ALUMINUM IN MERCURY-CATALYZED NITRIC ACID
R. H. Ray 24 Apr. 1964 20 p refs
(Contract AT(10-1)-205)
(IDO-14637) OTS: $0.50

Catalyst requirements in the continuous dissolution of aluminum in nitric acid were reduced significantly in a pilot dissolver by recirculating the dissolver effluent. At simulated plant conditions, the recirculation of dissolver effluent allowed the concentration of mercuric nitrate catalyst to be reduced by a factor of 3.2. Natural recirculation operation, demonstrated to be effective in the pilot plant, is recommended for the full-scale dissolvers to reduce the catalyst requirements. Author

N64-21780 Stanford Research Inst., Menlo Park, Calif.
RADIATION-INDUCED REACTIONS IN SWOLLEN POLYMERS Final Report
Zoila Reyes 30 Nov. 1963 44 p refs
(Contract AT(04-3)-115)
(SRI-A-120)

Studies were carried out on the effect of gamma irradiation on casein. Commerical casein irradiated under vacuum to a dose of 20 mrad yielded a gas consisting of 68% CO_2, 9% CO, 3% N_2, 18% H_2, and traces of CH_4, H_2O, O_2, and alcohols. The G value was 1.6. Some degradation took place as shown by a gradual decrease in the inherent viscosity of casein. The different electrophoretic patterns obtained for irradiated and unirradiated casein samples confirmed structural changes caused by gamma irradiation. Radiation-induced grafting of styrene and acrylonitrile to casein was studied by direct irradiation of casein swollen in monomer-solvent mixtures and by postirradiation swelling irradiated casein in the same mixtures. Water, methanol, aqueous methanol, and dilute ammonia-methanol were evaluated as swelling medium for grafting. Aqueous methanol was best for acrylonitrile and dilute ammonia-methanol for styrene. Molecular weight measurements were made of benzene-soluble acid hydrolyzates of casein–styrene grafts. Acid hydrolysis of a casein-acrylonitrile graft yielded a modified polyacrylonitrile with a molecular weight of 1.6×10^6. A.W.

N64-21799 Bureau of Mines, Reno, Nev.
ELECTRODEPOSITION OF MOLYBDENUM METAL FROM MOLTEN ELECTROLYTES
H. J. Heinen and J. B. Zadra [1964] 21 p refs
(BM-RI-6444)

Electrowinning molybdenum from oxide feed materials dissolved in a variety of molten baths was investigated. An NaCl-NaF-$Na_2B_4O_7$-MoO_3 system operating at 1,000° C in a cell without a protective atmosphere gave the best current efficiency, metal-to-cathode adherence, and purity of electrowon metal. Technical-grade molybdic oxide, containing associated impurities of aluminum, iron, copper, silicon, and tungsten in combined quantities of 10%, was used as feed material to produce dendritic crystals of molybdenum metal containing less than 0.5% total base metal, carbon, and oxygen impurities. Arc-melting molybdenum electrowon from either chemically pure or commercial-grade MoO_3 produced ingots that contained less than 0.1% total impurities and had hardness readings of 168 to 200 Vhn. Author

N64-21800 Bureau of Mines, Salt Lake City, Utah
ELECTROCHEMICAL RECOVERY OF COBALT-NICKEL ALLOY FROM SUPERALLOY SCRAP
Masami Hayashi, Donald R. Peterson, and D. W. Bridges 1964 40 p refs
(BM-RI-6445)

This report describes the laboratory development of a process for recovering a cobalt–nickel master alloy from superalloy scrap by electrochemical means. Specifically, scrap anodes are dissolved, and a cobalt–nickel alloy is deposited simultaneously at the cathode in an electrolytic cell partitioned by permeable diaphragms into separate anode and cathode compartments. N.E.A.

N64-21801 Iowa State U. of Science and Tech., Ames Ames Lab.
EMISSION SPECTROSCOPIC TECHNIQUES IN TURBULENT MASS TRANSFER STUDIES
Alan Melvin Bekelman and Ray Fahien May 1963 119 p refs
(Contract W-7405-ENG-82)
(IS-738) OTS: $2.50

A study was conducted to obtain accurate point values of the radical turbulent diffusion coefficient and the axial turbulent diffusion coefficient simultaneously. The emission spectroscopic method was used to obtain the desired gas-phase unsteady-state point-concentration data necessary to solve the unsteady-state continuity equation. The spectroscopic technique, using a d.c. power source, was free from the stray electromagnetic radiation problems involved in using the Tesla-coil power supply. It is recommended that a photomultiplier tube of high-blue sensitivity and a control gap be employed with the d.c. power-supplied spectrographic technique to obtain the desired unsteady-state point-concentration data. J.R.C.

N64-21806 Naval Radiological Defense Lab., San Francisco, Calif.
RADICAL YIELDS IN IRRADIATED AROMATICS
J. I. Mc Andrews, T. H. Anderson, and S. B. Martin 31 Jan. 1964 31 p refs
(USNRDL-TR-718; AD-434046)

The relatively high efficiency of production of free radicals, which become stabilized at liquid nitrogen temperature during the radiolysis of several aromatic hydrocarbons, demonstrates the quantitative importance of these intermediates in the mechanism of radiation decomposition. The required measurement of G(R·) values necessitated the indirect approach of comparing partially saturated ESR absorption spectra at high powers and then evaluating the extent of saturation in an independent measurement. G(R·) values are: benzene, 0.32; toluene, 0.53; biphenyl and naphthalene, 0.10. The results average about one-third of the corresponding values for radiolysis at room temperature. Author

N64-21819 Naval Research Lab., Washington, D.C.
ATTENUATED TOTAL REFLECTANCE INFRARED SPECTROSCOPY AS AN ANALYTICAL TOOL
R. A. Miller and F. J. Campbell *In its* Report of NRL Progress May 1964 p 11–16 refs (See N64-21817 15-01) OTS: $1.25

Infrared spectra of several different materials have been obtained by the attenuated total reflectance (ATR) technique. The materials included both transparent and pigmented plastics of various thicknesses and organic coatings of various formulations. These spectra were found to be comparable to those obtained by conventional infrared techniques. The ATR technique, however, makes it possible to obtain the infrared spectra of solid samples without modifying the specimen, and therefore should find wide use in many fields. Author

N64-21835 General Motors Corp., Indianapolis, Ind. Allison Div.
SURVEY OF ELECTROCHEMICAL TECHNOLOGY APPLICABLE TO WATER ELECTROLYSIS
R. A. Foust, Jr. Mar. 1964 187 p refs
(Contract AT(30-1)-3101)
(EDR-3687, Vol. II)

The purpose of this survey was to provide a sound basis for the development of the Energy Depot Water Electrolysis Unit that requires low-weight and high-energy efficiency, as well as to define and delimit the critical factors involved, along with the potentially troublesome areas in the development program. Following an introductory description of the Energy Depot Electrolysis Unit and its requirements, an electrochemical theory is presented. A review of the present status of electrolysis is given. Catalyst life, electrolyte, temperature, gas bubbles, pressurized operation, and a.c. ripple are also surveyed. N.E.A.

N64-21857 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 81
28 Apr. 1964 27 p refs Transl. into ENGLISH of 4 articles from K'o Hsueh T'ung Pao (Peking), no. 1, 1964 p 52–56, 71–73, 76–77
(JPRS-24372; OTS-64-31167) OTS: $0.75

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N64-21858 Joint Publications Research Service, Washington, D.C.
LIGHT AND SPECTROSCOPIC PROPERTIES OF INORGANIC VITREOUS RARE EARTH OXIDES
Kan Fu-Hsi, Chiang Chung-Hung, T'Sai Ying-Shih, and Hsiao Kao-Yen *In its* Transl. on Communist China's Sci. and Technol. 28 Apr. 1964 p 1–6 refs (See N64-21857 15-07) OTS: $0.75

The fluorescent spectra of several rare-earth ions in silicate glass were measured. The fluorescent spectra of rare-earth ions in different base materials (crystals and glass) are not similar. The effect of the base material is first indicated in the altering of the leaping probability between different energy levels and therefore causing vast changes in the intensities of the fluorescent rays. In crystals, the most intense fluorescence (480 mμ) is excited by ultraviolet rays, whereas in glass, ultraviolet rays fail to excite Pr^{3+}; its 880 mμ nearly infrared fluorescence is absorbed near 440 mμ to 500 mμ. Also, the intensity of fluorescence rays in inorganic glass is affected by the vitreous system. The intensity of the fluorescent peak of Nd^{3+} at 880 mμ and 1,060 mμ decreases gradually as the base materials are changed in the order fluoride glass → phosphate glass → silicate glass → borate glass. The effect of these vitreous systems on the fluorescent intensity is also observed in other rare-earth ions, such as Yb^{3+} activated glass. I.v.L.

N64-21859 Joint Publications Research Service, Washington, D.C.
PHYSICAL RESEARCH OF IRRADIATIVE RADIATION EMANATION OF ND^{3+} ACTIVATED INORGANIC VITREOUS STATES
Kan Fu-Hsi, Chiang Chung-Hung, and T'Sai Ying-Shih *In its* Transl. on Communist China's Sci. and Technol. 28 Apr. 1964 p 7–12 refs (See N64-21857 15-07) OTS: $0.75

A study of the absorption, fluorescence, and spectra of neodymium oxide is presented. Work was performed to determine how neodymium oxide concentration affects the intensity and duration of fluorescence. Temperature eruptive deactivation of fluorescence and the irradiative radiation emanation of Nd^{3+} activated glass are discussed. N.E.A.

N64-21860 Joint Publications Research Service, Washington, D.C.
ENRICHED TANTALUM CALCITE

T'ung Wu and Chang Ching *In its* Transl. on Communist China's Sci. and Technol. 28 Apr. 1964 p 13–19 refs (See N64-21857 15-07) OTS: $0.75

This report discusses (1) powdery crystal data of enriched tantalum calcite and calcite; (2) chemical composition of enriched tantalum calcite; and (3) rare-earth elements analytical results of enriched tantalum calcite and enriched yttrium calcite. N.E.A.

N64-21861 Joint Publications Research Service, Washington, D.C.
ACTIVITY OF A $PbO\text{-}BiO_{1.5}$ FUSED BODY
Tsou Yuan-Hsi *In its* Transl. on Communist China's Sci. and Technol. 28 Apr. 1964 p 20–24 refs (See N64-21857 15-07) OTS: $0.75

Calculated activity data show a divergence of $PbO\text{-}BiO_{1.5}$ from the laws of regular liquids. The divergence can be explained by using the difference in the electrical charge of Pb^{++} and Bi^{+++} ions and the radius (Pb^{++}, 0.94 A; Bi^{+++}, 0.81 A) so that their random distribution is effected. N.E.A.

N64-21906 Belcher (R.)
SUBMICRO METHODS FOR THE ANALYSIS OF ORGANIC COMPOUNDS. A: DETERMINATION OF ORGANIC FUNCTIONAL GROUPS Final Technical Report, Sep. 1962–Sep. 1963
R. Belcher 1963 22 p
(Contract DA-91-591-EUC-2387)

The determination of functional groups on the microgram scale was continued. The present report describes methods developed for the determination of sulfhydryl groups, nitroso and other nitrogen-containing groups, vicinal glycols (Malaprade reaction), and olefinic unsaturation. Author

N64-21907 Max-Planck-Institut für Chemie, Mainz (W. Germany) Otto-Hahn-Inst.
TRITIUM DETERMINATIONS IN ATMOSPHERIC GASES AND METEORITES Final Report
F. Begemann Nov. 1963 42 p refs
(Contract AF 61(052)-465)
(AFCRL-64-233; AD-601129)

From 1958–1962 the T in atmospheric hydrogen increased from $T/H = 2.5 \times 10^{-13}$ to 5.5×10^{-13} and during the winter 1962–1963 to 20×10^{-13}. The results, not corrected for contamination of the samples by means of D determinations, are in general agreement with predictions based on fallout data and the deposition of HTO. During the same time the T content of atmospheric methane stayed essentially constant ($T/H = 2 \times 10^{-14}$). It is concluded that exchange reactions between Ht and CH_4 are not a major source of the CH_3T. The mean lifetime of CH_4 in the atmosphere is longer than 14 years. Author

N64-21914 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
ON THE LAWS OF POLYCOORDINATION AND NEW COORDINATION POLYMERS Letters to the Editor
V. V. Korshak, S. V. Vinogradova, V. A. Artemova, T. M. Babchintser, and S. A. Pavlova 20 May 1964 6 p ref Transl. into ENGLISH from Vysokomol. Soyedineniya (USSR), v. 3, no. 7, 1961 p 1116
(RSIC-184; AD-600997)

The laws of the polycoordination process are found to be analogous to the laws of the equilibrium polycondensation process when coordination polymers are obtained from tetradentate organic ligand and acetylacetone or metallic salt, under the usual conditions. The most interesting of these laws are those that determine the molecular weight value of the polymer obtained. A polymer of high-molecular weight with a polycoordination of 4,4'-bis(acetoacetyl) phenyl ether was obtained with acetylacetone of beryllium. For the purpose of finding new ways of synthesizing coordination polymers, three types of reactions were investigated: (1) polyrecombination reaction; (2) the reaction of ethers with terminal acetoacetate groups having metallic derivatives; and (3) the reaction of low-molecular polyethers with complexing terminal groups having metallic derivatives. Author

N64-21921 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CATALYTIC ACTIVITY OF ORGANIC POLYMERS
N. P. Keyer and I. V. Astaf'yev 22 Jan. 1963 6 p refs Transl. into ENGLISH from Kinetika i Kataliz (USSR), v. III, no. 3, 1962 p 364–365
(FTD-TT-62-1650/1+2+4; AD-298220)

The catalytic activity of a polymer obtained by the dehydrochlorination of polyvinylidene chloride was studied. Catalytic activity was detected in the decomposition of formic acid and isopropyl alcohol in the direction of dehydrogenation. Hydrazine undergoes 90% decomposition into ammonia and nitrogen. The polymer possesses high chemical adsorbability. Author

N64-21937 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ZEOLITES—MOLECULAR SIEVES
P. P. Budnikov and I. M. Petrovykh 11 Dec. 1963 12 p Transl. into ENGLISH from Priroda (USSR), no. 7, 1963 p 32–37
(FTD-TT-63-979/1+2; AD-426902)

A brief discussion is presented of the formation of zeolites in nature, the structure of zeolites, and the synthesis of molecular sieves based on the use of artificially produced zeolites. P.V.E.

N64-21968 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF OBTAINING A HEAT-RESISTANT PARAMAGNETIC POLYMER
V. P. Parini and A. A. Berlin 26 Feb. 1963 4 p Transl. into ENGLISH from Soviet Patent no. 148517, 7 Jul. 1961 p 1
(FTD-TT-62-1882/1+4; AD-400545)

The method of obtaining a heat-resistant paramagnetic polymer by the reaction of diamine with quinone has the distinguishing feature that in order to expand the raw materials, aromatic diamine is subjected to a reaction with quinone, free of labile hydrogen atoms adjacent to the keto group. The polymers thus obtained have increased heat resistance; their specific electrical conductance at 25° C is 10^{-9} to $10^{-7}ohm^{-1}cm^{-1}$, with conductance energy of 0.25 to 0.3 ev. N.E.A.

N64-21972 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE NATURE OF POLYAMIDE DESTRUCTION DURING CONTACT STRESSES
Ye. A. Fedorchuk 13 Apr. 1964 8 p refs Transl. into ENGLISH from Plasticheskie Massy (USSR), no. 5, 1963 p 56–58
(FTD-TT-64-126/1+2+4; AD-600612)

The nature of fatigue destruction of polyamide resins under contact stresses is investigated, using a roller machine in which an experimental polyamide roller revolved, virtually without slippage, against a steel roller. Two types of destruction were found: (1) purely fatigue destruction, which occurs when fissures spread through the whole depth of the material

and leads to peeling of the surface; and (2) heat destruction, which occurs at increased loads and rpms as a result of internal melting in the maximal tangential stress zone and leads to puncture of the surface. It is concluded that, in contrast to other plastics, the contact endurance of polyamides is dependent upon load frequency. M.P.G.

N64-21975 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE EFFECT OF BREMSSTRAHLUNG OF A 25 MEV BETATRON AND ULTRAVIOLET RAYS ON MINERAL OILS

S. Z. Kaplan, A. P. Bazin et al 24 Apr. 1964 14 p refs Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 8, 1963 p 57–61
(FTD-TT-64-224/1+2-4; AD-600584)

Bremsstrahlung action of a betatron with maximum energy of 25 Mev (doses 10^5 to 10^6 r) and ultraviolet radiation on turbine oil thickened with polymers was studied. It was found that during betatron irradiation in an open vessel with insufficient air intake, the acid numbers of the thickened oils decreased, and their viscosity did not change. In the infrared spectra of betatron-irradiated oil, a decrease was observed in the absorption-band intensity corresponding to fluctuations in the groups $=CH_2$ and $—CH_3$. But after UV irradiation, the intensity of these bands increased. During betatron irradiation in an open vessel filled with transformer oil (dose 10^6 r), the acid number of the oil increased, and its electrical insulating properties deteriorated. As a result of irradiation, beta-active isotopes of Fe^{53} and Na^{24} appeared. Author

N64-21976 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TEMPERATURE PROFILES UPON BURNING OF AMMONIUM PERCHLORATE

V. K. Bobolev, A. P. Glazkova et al 11 May 1964 11 p refs Transl. into ENGLISH from Doklady An SSSR, Fiz. Khim. (USSR), v. 151, no. 3, 1963 p 604–607
(FTD-TT-64-327/1+2+4; AD-600507)

Temperature profiles were obtained in the 40 to 350 atm pressure range, which indicate two regimes of ammonium perchlorate burning: stable (40 to 150 atm) and unstable (160 to 350 atm). Anomalous dependences of surface temperature and heat release in the condensed phase on pressure were established and show that they fall when the pressure is increased. The drop in burning velocity with an increase in pressure and the catalytic effect of products diffusing from the reaction zone in the gas phase to the surface indicate a gasification reaction of the condensed phase. Author

N64-22045 Brookhaven National Lab., Upton, N.Y.

THE EFFECT OF REACTOR IRRADIATION UPON HYDROGEN ADSORPTION BY AN ALUMINA CATALYST

D. B. Rosenblatt and G. J. Dienes Feb. 1964 9 p refs
(Sponsored by AEC)
(BNL-845(T-332)) OTS: $0.50

Hydrogen adsorption experiments were carried out on unirradiated and reactor-irradiated samples of gamma alumina (γ-Al_2O_3) in an effort to interpret the known enhancement by radiation of the catalytic activity of this material. The specific surface area of 85 m^2/g was not changed by irradiation, but the shapes of the hydrogen adsorption isotherms were altered. The observed monolayer capacity for hydrogen indicates that hydrogen atoms are adsorbed (at 78° K) in one-to-one correspondence with the oxygen ions in the alumina surface. Nitrogen contamination, which is not removed by outgassing at 300° C, has been detected. It is displaced systematically as hydrogen is adsorbed at 78° K. Reactor irradiation appears to enhance this nitrogen release phenomenon. Author

N64-22050 Northern Polytechnic, London (Gt. Brit.)

HIGH-TEMPERATURE OR LOW-TEMPERATURE RESISTING ELASTOMERS CONTAINING BORON Final Technical Report No. 2, 1 Feb. 1963–31 Jan. 1964

W. Gerrard 17 Feb. 1964 10 p
(Contract DA-91-591-EUC-2809)
(AD-434904)

Two mechanisms for the mole-scale production of *o*-ethylphenylboron dichloride from *o*-ethylphenylmercury chloride leading to the production of a polycondensate with bis(2-chloroethyl)vinylphosphonate are presented. Infusible vinyl polymerication at some stage of the condensation was sought, but correct conditions were not found. R.T.K.

N64-22051 Pennsylvania U., Philadelphia Electrochemistry Lab.

HYDROGEN EMBRITTLEMENT RESULTING FROM CORROSION, CATHODIC PROTECTION, AND ELECTROPLATING

L. Nanis and J. Mc Breen 31 Jan. 1964 17 p refs
(Contract N156-44134)
(QR-1; AD-434914)

To ascertain the degree of temperature control required with permeation experiments, the effect of temperature on the diffusion coefficient and permeation of hydrogen through Armco iron and AISI-4340 steel was investigated. The temperature range used was from 10° C to 75° C. The temperature control was maintained by containing the cell in an air thermostat. Temperature control in all cases was to within ± 0.5° C. The effect of stress on the diffusion coefficient was investigated for Armco iron. Permeation transients were recorded on a high-speed fast-response recorder using a battery operated electrometer as a preamplifier. It was possible to record permeation transient with a very high degree of resolution in the time scale. A plot of log D (diffusion coefficient) vs reciprocal absolute temperature for Armco iron is shown, and a similar plot is shown for AISI-4340 steel. For Armco iron in the range 0 to 33,000 lbs/sq in. tensile stress, no change of D with stress was observed to within the experimental error of ±2%. R.T.K.

N64-22062* Florida State U., Tallahassee Inst. of Molecular Biophysics

IRRADIATION CROSSLINKING OF POLYETHYLENE: RELATIVE EFFICIENCY IN CRYSTALLINE AND AMORPHOUS STATES

R. Kitamaru, L. Mandelkern, and J. Fatou Repr. from Polymer Letters, v. 2, 1964 p 511–517 refs
(Grant NsG-247-62)

Experimental results are discussed that deal with the general theory of intermolecular crosslinking and, more specifically, with the relative efficiency of crosslinking or crystalline and amorphous linear polyethylene. Molecular weight fractions from a wide range in molecular weight were used. In the experiments, irradiations were conducted at a temperature at which the same molecular weight fractions were maintained either in the completely amorphous state or in a state characterized by a very high level of crystallinity. P.V.E.

N64-22078* Rensselaer Polytechnic Inst., Troy, N.Y. Interdisciplinary Materials Research Center

Al^{27} QUADRUPOLE COUPLING IN SOLID $AlCl_3$

P. A. Casabella and N. C. Miller Repr. from J. Chem. Phys., v. 40, no. 5, 1 Mar. 1964 p 1363–1368 refs
(Grant NSG-100-60)

The nuclear quadrupole coupling constant of Al^{27} in solid anhydrous $AlCl_3$ was 472 ±24 kc/sec with an electric field gradient asymmetry parameter of zero. Assuming the crystal to be completely ionic, the electric field gradient was calculated for the layered $AlCl_3$ structure by summing the contributions of the near ions and by treating the rest of the crystal as being made up of uniformly charged planes. This calculation gives an Al^{27} quadrupole coupling constant of −2.78 mc/sec and an electric field gradient asymmetry parameter of zero. The addition of some covalent bonding tends to reduce the magnitude of the coupling constant and bring it into better agreement with the experimental value. It is estimated that the crystal is two-thirds ionic and one-third covalent. Author

N64-22085 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
DEVELOPMENT OF AIR DISTRIBUTOR CAPS FOR A FLUIDIZED BED
J. C. Petrie and D. E. Black Apr. 1964 22 p refs
(Contract AT(10-1)-205)
(IDO-14629) OTS: $0.50

Results are presented of a pilot plant study of factors that affect erosion and performance of caps installed on an air distributor plate in a fluidized bed calciner. The study was initiated because of the excessive erosion experienced on the original air distributor caps installed in the calciner vessel at the ICPP Waste Calcining Facility. Laboratory techniques that considerably reduce the time required to obtain erosion data in tests are described. A theoretical orifice formula is given that accurately predicts the pressure differential across the geometrically complex orifices in the air distributor plate. Details are given of the air distributor cap selected for use in radioactive operation of the Waste Calcining Facility as a result of these tests. Author

N64-22101 Bureau of Mines, Norris, Tenn.
SYNTHESIS AND SOME PROPERTIES OF FIBROUS SILICON NITRIDE
Robert C. Johnson, Wilbur H. Warwick, and H. R. Shell 1964 29 p refs
(BM-RI-6467)

Alpha silicon nitride fibers, Si_3N_4, were successfully grown in graphite crucibles by a new method utilizing silicates and silicon (S in equations below) as sources of silicon and using carbon, aluminum, and silicon as reducing agents (R in equations below). The basic reaction mechanism is believed to be generally as follows:

$$S + R + N_2 \xrightarrow{1,300^\circ \text{ to } 1,500^\circ \text{ C}} SiO + RO + N_2, \quad (1)$$

$$3SiO + R + 2N_2 \xrightarrow{1,300^\circ \text{ to } 1,500^\circ \text{ C}} 3RO + Si_3N_4. \quad (2)$$

A buildup of coatings on the solid raw-material particles hindered the evolution of silicon or silicon monoxide vapor and thereby slowed down further formation of silicon nitride fibers. Free oxygen in the crucible caused the formation of amorphous silicon dioxide (SiO_2) fibers. This problem was solved by passing, entering, and exiting gases through layers of lump graphite inside the reaction vessel. The silicon nitride fibers grew best around 1,400° C. Author

N64-22103 Mound Lab., Miamisburg, Ohio
COMPARATIVE PROPERTIES OF HELIUM-3 AND HELIUM-4
D. P. Kelly and W. J. Haubach 1 Jun. 1964 57 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1161) OTS: $1.25

This report contains a comprehensive graphical presentation of the physical, thermodynamic, and quantum mechanical properties of helium-3 and helium-4. Wherever possible, the properties are presented on the same graph for direct comparison. Some data on the properties of helium-3–helium-4 mixtures are also included. N.E.A.

N64-22120 Bureau of Mines, Boulder City, Nev.
PREPARATION OF TITANIUM NITRIDE
E. K. Kleespies and T. A. Henrie (Bureau of Mines, Reno, Nev.) 1964 12 p refs
(BM-RI-6447)

Carbon reduction of rutile and ilmenite in nitrogen and ammonia atmospheres was studied as a method of preparing titanium nitride. Ammonia was a better nitriding agent than nitrogen. The contact between the solid reactants, carbon and rutile, was a prime factor in nitrogen atmospheres and was of lesser import in dissociated ammonia. The reduction process for conversion of rutile to the nitride required carbon. The nitriding of ilmenite–carbon mixtures produced titanium nitride and elemental iron. Author

N64-22126 Union Carbide Research Inst., Tarrytown, N.Y.
FLUORINE OXIDIZERS
R. Didchenko and R. H. Toeniskoetter [1964] 17 p refs
(Contract DA-31-124-ARO(D)-77; ARPA Order-402)
(QTSR-3; AD-433910)

The following are discussed: (1) electrolytic studies in BrF_3—electrolysis of $KBrF_4$-BrF_3 systems; electrolysis of K_2ClO_3F in BrF_3; electrolysis of the system KBr_4-BrF_3-ClO_3F; electrolysis of the system $KBrF_4$-BrF_3-N_2F_4; preparation of fluorochlorates of Cu, K, and Ba; and preparation and electrolysis of K_2ClO_3F-BrF_3 solution; (2) the existence of $F\bar{O}_3$ ion; and (3) glow-discharge electrolysis. R.T.K.

N64-22127 Washington U., Seattle
SECONDARY ISOTOPE EFFECTS IN THE CHEMICALLY ACTIVATED SEC-BUTYL-D_0 AND -D_8 SYSTEMS AND SEC-BUTYL-D_1 AND -D_9 SYSTEMS
J. W. Simons, B. S. Rabinovitch, and R. F. Kubin [1963] 36 p refs
(Sponsored by ONR)
(AD-432304)

The decomposition of chemically activated *sec*-butyl-d_8 and -d_9 radicals, produced by H- and D-atom addition to *cis*-butene-2-d_8, has been studied at 195° and 300° K over a range of pressures. These measurements, as well as internal comparison experiments with *cis*-butene-2-d_0, reveal a large, normal secondary, intermolecular kinetic isotope ratio that varies with the pressure and temperature, whose minimum value is a factor of 4, and whose maximum value averages around 7. The absolute magnitude of the ratio, and its temperature, pressure, and energy dependence are in satisfactory agreement with the theory of these chemical activation systems; some aspects of this dependence are discussed. Evidence against a significant mechanistic isotope effect on the energetics is presented. Calculated isotope effects for all of the possible *sec*-butyl radical systems, to be formed by H- and D-atom addition to butene-d_0 and -d_9 isomers, are given. Author

N64-22149 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A STUDY OF CONFORMATIONAL CHANGES IN MACROMOLECULES IN SOLUTIONS. III: CONFORMATIONAL CHANGES IN 2-VINYLPYRIDINE-METHACRYLIC ACID COPOLYMER

I. T. Slyusarov and S. S. Urazovskiy 14 Jan. 1963 11 p refs Transl. into ENGLISH from Vysokomolekul. Soyedin. (USSR), no. 4, 1962 p 481–485
(FTD-TT-62-1572/1+2+4; AD-298215)

This report gives the results of studies of the viscosity, electrical conductivity, and hydrogen-ion concentration of aqueous solutions of vinylpyridine-methacrylic acid copolymer in acid and alkali media over a wide range of pH, and also the viscosity of water-methanol and dimethylformamide solutions of polyampholyte at concentrations from 0.05 to 1 g/dl from 20° to 60° C. N.E.A.

N64-22194 Washington U., Seattle
REACTIONS OF FLUORINE NITRATE
George H. Cady and Barry Tittle [1964] 8 p refs
(Contract Nonr-477(16); ARPA Order 26-60)
(TR-46; AD-433545)

Reactions of fluorine nitrate with tetrafluoroethylene, ethylene, tetrafluorohydrazine, and sulphur tetrafluoride are reported along with that of a thermal reaction of equimolar amounts of fluorine nitrate and sulphurtetrafluoride. R.T.K.

N64-22233 Oak Ridge National Lab., Tenn. Isotopes Development Center
ORNL RADIOISOTOPES PROCEDURES MANUAL
D. A. Fuccillo, Jr. and Sylvia B. Ewing, comp. Jun. 1964 178 p refs
(Contract W-7405-ENG-26)
(ORNL-3633) OTS: $3.00

This manual presents the detailed procedures used at ORNL in the chemical processing of neutron-produced and short-lived fission-product radioisotopes. The format of the manual in general follows the production sequence. Section II describes target selection, target preparation, reactor irradiation, and processing principles. Section III contains detailed procedures for each radioisotope, and Section IV describes the storage and shipping operations. Descriptions of the Oak Ridge Research Reactor and the chemical processing facilities, tabulated reactor production data for each isotope product, analytical techniques, and a bibliography are also given. N.E.A.

N64-22253 India Dept. of Atomic Energy, Bombay Analytical Div.
SEPARATION OF THE CHLORINATED EARTH ACIDS FROM THE UNREACTED ONES IN FUSED ELECTROLYTIC BATHS AND THEIR INDIVIDUAL DETERMINATION
N. Krishnamachari and C. Venkateswarlu 1963 8 p refs
(AEET-ANAL.-15)

The chlorinated oxides of niobium and tantalum are separated from the unreacted earth acids by boiling in a mixture of oxalic and hydrochloric acids. The unreacted earth acids remain insoluble whereas the hydrous oxides formed from chlorinated material readily dissolve. The niobium content of each fraction is determined by measuring the absorption of the mixed complex with gallic acid and EDTA in tartrate medium and the tantalum content by difference. Author

N64-22268 University Coll. of Wales, Aberystwyth (Gt. Brit.) Edward Davies Chemical Lab.
INFRA-RED, ULTRASONIC AND THEORETICAL STUDIES OF MOLECULAR STRUCTURE Annual Summary Report No. 1, 1 Mar. 1963–29 Feb. 1964
W. J. Orville-Thomas. [1964] 5 p refs
(Contract AF 61(052)-691)
(AFCRL-64-368; AD-600895)

Studies carried out in the following areas are summarized: (1) infrared absorption; (2) infrared dispersion; (3) ultrasonics; and (4) theoretical studies of force constants, molecular parameters, and bond structure. P.V.E.

N64-22283 Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE PHOTOLYSIS OF NITRIC OXIDE IN THE PRESENCE OF OLEFINS
John J. Mc Gee and Julian Heicklen 11 May 1964 10 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-82; TDR-269(4240-20)-2; AD-601223)

Electronically excited nitric oxide ($A^2\Sigma$) produced by irradiation with the 2,665 A and 2,155 A lines of a cadmium arc induces the decomposition of ethylene to acetylene and hydrogen, apparently by a molecular mechanism. The acetylene, which also absorbs the radiation, photolytically reacts with the nitric oxide to give a solid deposit. Author

N64-22347 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN SCIENTIFIC PROBLEMS IN THE FIELD OF THE CHEMISTRY AND TECHNOLOGY OF REFRACTORIES
17 May 1963 8 p Transl. into ENGLISH from Ogneupory (Moscow), no. 7, 1962 p 297–299
(FTD-TT-63-323/1+4; AD-409911)

Investigations in the field of refractories are faced with the following problems: (1) further study of the physicotechnical properties of refractories and their crystal structure; (2) the development of effective methods of synthesizing high-refractory substances; (3) a study of the phase diagrams of systems having high-refractory components; (4) the development of the physics and physicochemistry of polydispersed systems; (5) the study of recrystallization processes and the sintering of high-refractory substances; (6) the study of the kinetics and mechanics of the wear of refractory materials during service and a search for methods to increase their stability; (7) the perfecting of methods for the enrichment of refractory raw materials; (8) the perfecting of the technology of producing chrome-magnesites, chrome-dolomites, periclase, high-aluminas, etc. to insure intensification of metallurgical processes; and (9) the development of new express-control methods for the production and quality control of refractories. I.v.L.

N64-22349 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROLYTIC PRECIPITATION OF SUBSTANCES AND MIXES FOR THE SYNTHESIS OF HIGH-QUALITY FERRITES
F. Foniak and W. Nowakowski 7 Jun. 1963 27 p Transl. into ENGLISH from Przeg. Elek. (Poland), v. 3, no. 8, 1962 487–503
(FTD-TT-63-348/1+2+3+4; AD-409178)

This article describes an electrochemical method for obtaining raw materials and mixtures for the synthesis of high-quality ferrites, using easily accessible domestic metallic electrodes. The basic processes occurring during the electrolytic precipitation of the raw substances and their mixtures are briefly discussed, the apparatus employed is described, and the results obtained for metallic iron, nickel, and zinc are discussed. The synthesis of nickel–zinc ferrites is described. Author

N64-22359 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LIQUID CRYSTALS

A. Volkov and I. Christyakov 5 Dec. 1963 7 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 9, 1960 p 22–23
(FTD-TT-63-958/1+2; AD-426672)

Liquids with anisotropic or crystalline properties are known as liquid crystals. In a definite temperature range they exhibit both properties of liquids (fluidity and drop-forming capability) and of crystals (optical, electrical, magnetic anisotropy). On cooling to a certain temperature, liquid crystals turn to ordinary solid crystals. Examples cited as liquid crystals are cholesterol acetate, potassium oleate, and sodium oleate. A brief review of the history of liquid crystals and controversies over their properties are discussed. N.E.A.

N64-22456* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
INFRARED EMISSION SPECTRA OF ORGANIC SOLIDS FROM 5 TO 6.6 MICRONS
W. A. Hovis, Jr. Repr. from Science, v. 143, no. 3606, 7 Feb. 1964 p 587–588 refs
(Contract NAS7-100)
(NASA-CR-56284; JPL-32-547)

The emission spectra of thin layers of a number of organic solids have been studied from 5μ to 6.6μ in the infrared to determine if there are specific emission characteristics that would allow identification of such solids as organic. This was the case only for very thin films with strong absorption bands. Author

N64-22462* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Materials Research and Development
THE CONTAINMENT OF MOLTEN LITHIUM HYDRIDE AT ELEVATED TEMPERATURES Engineering Report, 1 Jan. 1962 – 1 Oct. 1963
E. J. Vargo, D. B. Cooper, and J. B. Pearson, Jr. 15 Feb. 1964 75 p refs
(Contract NAS5-462)
(NASA-CR-54053; ER-5787) OTS: $7.60 ph

The problems associated with the containment of molten lithium hydride, corrosion by lithium hydride, and the loss of hydrogen because of high hydrogen permeability of the container materials were investigated by a series of capsule tests. These tests, performed isothermally and at cyclic elevated temperatures, were operated for periods up to 5,177 hours. The corrosive effect of lithium hydride was determined for two materials, Haynes alloy No. 25 and Type 316 SS. The hydrogen barrier effects of various coatings applied to the above materials also were evaluated from these capsule tests. The feasibility of using modified conventional techniques to form and join glass coated metals such that a Sunflower system heat receiver and boiler could be fabricated was demonstrated. The favorable hydrogen permeability of a unique laminated tube structure also was demonstrated. From the data obtained in this investigation and the hydrogen permeability data obtained in an associated investigation, a selection of a satisfactory material for the containment of lithium hydride was made. The calculated loss of hydrogen to be expected after a 1-year operation of the Sunflower system was 1.73 lb or 13.84 lb of lithium hydride. Author

N64-22506 Naval Research Lab., Washington, D.C. Chemistry Div.
THE SOLUBILITY OF COLUMBIUM-1% ZIRCONIUM IN SODIUM BY ACTIVATION ANALYSIS
T. A. Kovacina and R. R. Miller 20 Mar. 1964 9 p refs
(Contract NAS-C-76320)
(NRL-6051; AD-600070)

The equilibrium solubility of the refractory alloy (Cb-1% Zr) in liquid sodium in the temperature range of 800° to 1,380° C was determined under static, isothermal conditions. The standard comparator method of activation analysis was used to determine the columbium and zirconium content of the equilibrated sodium samples. The solubility ranges were estimated to be 0.25 to 250 ppm and 0.08 to 4 ppm by weight for columbium and zirconium, respectively. Author

N64-22538 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.
A GENERALIZED THEORY OF PARTICULATE ELECTRON CONDUCTION ENZYMES APPLIED TO CYTOCHROME OXIDASE. A THEORY OF COUPLED ELECTRON AND/OR ION TRANSPORT APPLIED TO PYRUVATE CARBOXYLASE Report No. 25
Freeman W. Cope 30 Apr. 1964 30 p refs
(NADC-ML-6405; AD-601190)

A previously developed theory of particulate electron conduction enzymes was based on a model of an enzyme particle catalyzing the oxidation–reduction of two different substrates at two different enzymatic sites on the same particle, with conduction of electrons between the two sites through the enzyme particle. Using the simplifying assumption that the percent reduction of the second substrate is held constant, there was previously shown to be a hyperbolic relationship between the first order rate constant (k') and the sum (C_x) of oxidized plus reduced substrate, of the form $k' = \alpha/(C_x + \beta)$, where α and β are positive constants. It is shown here that if this simplifying assumption is omitted, a positive constant is added to the right hand side of this equation, which describes exactly the experimental data of Smith and Conrad on cytochrome oxidase. If electron transport is assumed to be coupled to ion transport, this equation becomes $k' = (\alpha/C_x) - \gamma$ (where γ is a positive constant), which describes the experimental data of Eadie and Gale on pyruvic carboxylase of yeast. Author

N64-22539 Humble Oil and Refining Co., Baytown, Tex.
ENERGETICS OF SOME GASEOUS OXYGENATED ORGANIC IONS
M. S. B. Munson and J. L. Franklin Jun. 1964 21 p refs Submitted for Publication
(Contract Nonr-3623(00); Proj. Squid)
(HUM-7-P; AD-601272)

The heats of formation of some simple oxygenated organic compounds have been measured from different sources: $\Delta H_f(CH_2OH^+) = 174$ kcal/mole and $\Delta H_f(CH_3O^+) = 202$ kcal/mole. Similar differences exist for the isomers of mass 45. The proton affinities of formic, acetic, and propionic acids were determined from rearrangement ions of esters as about 170 to 180 kcal/mole. The protonated acid ions are readily formed by ionic reactions in the gaseous aliphatic acids. Appearance potential data for H_3O^+ and $CH_3OH_2^+$ may be interpreted to give $P(H_2O) \cong P(CH_3OH) \cong 170$ kcal/mole. Author

N64-22542 Stauffer Chemical Co., Richmond, Calif. Richmond Research Center
HIGH ENERGY OXIDIZERS
K. O. Christe, A. E. Pavlath, and E. G. Wallace [1964] 10 p refs
(Contract Nonr-4019(00); ARPA Order 399-62)
(QTSR-1; AD-441273)

The IR spectra of gaseous and solid chlorinetrifluoride and arsenicpentafluoride were taken and compared with the spectrum of $ClF_2^+AsF_6^-$ and $KAsF_6$. A comparison between the spectra indicated the presence of AsF_6^- in the complex. Analogous results were obtained for the $ClF_2^+BF_4^-$ complex. From the absorption of the ClF_2^+ cation it was concluded that it exists in an angular form and is not linear. The reaction

of $AgNO_3$, $KClO_4$, and N_2O with chlorinetrifluoride was studied in an attempt to prepare $ClF_2{}^+X^-$ where X^- was expected
Author

N64-22627 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE DETERMINATION OF HYDROCARBON TRACES IN ATMOSPHERIC AIR AND LIQUID OXYGEN
Jutta Theer 27 Feb. 1963 11 p refs Transl. into ENGLISH from Chem. Tech., (E. Germany), no. 3, 1962 p 164–167
(FTD-TT-62-1665/1+2+4; AD-401389)

An apparatus for gas chromatographic determination of hydrocarbon traces is described. With a sample quantity of 1 ml hydrocarbons to a quantity of 5×10^{-6}, vol. % can be determined in 5 min. In combination with adsorptive concentration, in 10 to 15 min. hydrocarbons to the quantity of 10^{-8} vol. % are demonstrable. In continuous operation, the described microflame ionization detector and automatic sampler gave a good account of themselves.
Author

N64-22632 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HYDROPURIFICATION OF A REFINED DIESEL OIL
R. Sh. Kuliyev and B. A. Sadykhova 30 Jan. 1963 7 p Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (USSR), no. 5, 1962 p 32–34
(FTD-TT-62-1735/1+2+4; AD-299673)

Hydropurification with Al-Co-Mo catalysts at a temperature of 350° C and a pressure of 50 atm produced a diesel oil with somewhat better physicochemical properties than similar oil obtained by repurification with 1% sulfuric acid and 5% clay. When the hydropurification was carried out at pressures greater than 50 atm (100 to 150 atm) an oil was produced that had considerably better quality than acid-contact repurification oils. It was also established that a WS_2 catalyst has a greater hydrogenating capacity than the Al-Co-Mo; however, an increase in temperature above 300° C leads to cracking in the presence of WS_2.
P.V.E.

N64-22640 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HIGH TEMPERATURE OXIDATION OF DISPERSED ALUMINUM
V. L. Korneyev and I. I. Vernidub 21 Feb. 1963 12 p Transl. into ENGLISH from Issled. po Zharoprochnym Splavam, Izd. Akad. Nauk SSSR (Moscow), v. 7, 1961 p 309–316
(FTD-TT-62-1833/1+2+4; AD-299653)

The process of high-temperature oxidation of aluminum powders is accompanied by fusion of the metal, its vaporization, and subsequent reactions of the aluminum vapor mixture with oxygen in the gaseous phase. If the supply of heat to the drop of liquid aluminum is insufficient, the chemical interaction of aluminum with oxygen acquires a pulsation represented by a series of successive flashes of aluminum vapor that periodically erupt into the reactor space through ruptures in the oxide film covering the drop. If the supply of heat to the liquid aluminum is sufficient after the first rupture of the oxide film by the pressure of the metal vapors, the surface of the drop of liquid aluminum is exposed, which insures continuous vaporization of the aluminum and the free escape of vapors into the reactor space. The completeness of the reaction of aluminum powders with oxygen amounts to 37% to 56% and increases to 81% to 99% in the case of preheating the metal powder and oxygen to 400°.
J.L.D.

N64-22642 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FUEL ADDITIVES, AN EFFECTIVE MEANS FOR RAISING THE MOTOR POWER OF POWER INSTALLATIONS
B. P. Botkin 21 Feb. 1963 13 p Transl. into ENGLISH from Energomashinostr. (Moscow), no. 6, 1962 p 26–28
(FTD-TT-62-1931/1+2+4; AD-299671)

The ability of petroleum additives to increase the power and to reduce wear in internal combustion engines was investigated. The following conclusions were reached on the basis of the investigation: (1) Fuel additives are one of the most effective means of increasing motor power and reliability of operation of internal combustion engines. By using fuel additives for diesels, wear in the cylinder–piston system can be reduced by 50%. (2) In diesel-power installations, it is expedient to use fuel and oil additives, the optimum concentration of fuel additive being determined experimentally.
P.V.E.

N64-22649 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROHYDRAULIC METHOD OF FEEDING AND ATOMIZING LIQUID FUELS AND OTHER LIQUIDS AND DEVICE FOR ITS ACCOMPLISHMENT
L. A. Yutkin and L. I. Gol'tsova 3 Jun. 1963 7 p Transl. into ENGLISH from Soviet Patent no. 119403, 20 Jan. 1951 p 1–3
(FTD-TT-63-478/1+2; AD-412975)

The proposed method of feeding and atomizing liquids and the device for this purpose are based on the complex action of a single electrohydraulic impact that occurs on dischargers in a volume of liquid inside a special device, which is used for supplying, atomizing, and pumping a new portion of the liquid. This device is in the form of a chamber, consisting of a hollow space and having one end closed by a movable piston. There is a channel at the inlet to the chamber; this channel is bent in the form of many elbows through which liquid is fed into the chamber. The purpose of the channel is to buffer the shock impulse that is traveling in the direction of the feeding reservoir. Through an analogously designed channel, the liquid constantly flows out of the chamber. A long nozzle for ejecting the liquid is located at the other end of the chamber.
I.v.L.

N64-22654 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RATE OF CHEMICAL REACTION AND ITS EFFECT ON THE PROCESS OF DROPLET COMBUSTION
V. R. Kuznetsov 24 Jul. 1963 9 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 2, no. 4, 1962 p 344–349
(FTD-TT-63-653/1+2; AD-419229)

A method is described that will make it possible to evaluate the amount of a fuel droplet that is unburned in an oxidizer stream and to explain the conditions at which the droplet can burn. Also calculated were the dependencies of the amount of uncombusted fuel (gasoline) upon the rate of oncoming airstream and the relationships between the temperature of the flow and its rate during flame separation.
J.L.D.

N64-22659 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PERFORMANCE OF POROUS ELECTRODES IN A DIFFUSION CONDITION OF FEEDING REAGENTS
I. G. Gurevich and V. S. Bagotskiy 22 Jul. 1963 14 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh., Akad. Nauk Belorusskoi SSR (Minsk), v. 6, no. 2, 1963 p 60–68
(FTD-TT-63-722/1+2; AD-419230)

The function of a porous electrode in a diffusion condition is considered. A case is discussed wherein an electrode of finite thickness is submerged in an electrolytic chamber, in which the working solution appears as electroneutral molecules in one instance and as electrolyte ions in other instances. Polarization and current over the depth of the porous electrode are described. N.E.A.

N64-22662 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF CONCENTRATION OF PERCHLORIC ACID ON ITS THERMAL DECOMPOSITION
V. P. Babayeva and A. A. Zinov'yev 26 Nov. 1963 12 p refs Transl. into ENGLISH from Zh. Neorg. Khim. (Moscow), v. 8, no. 3, 1963 p 567–572
(FTD-TT-63-832/1+2; AD-425496)

The decomposition of perchloric acid in concentrations ranging from 88.33% to 100% and temperatures ranging from 60° to 90° C was studied. The character of the decomposition depends neither on the concentration nor on the temperature. The activation energy of all the investigated compositions of the acid in the induction period was 32.84 Kcal/mole, but on reaching the maximum it was 22.58 Kcal/mole. It was confirmed that the monohydrate of perchloric acid in the investigated temperature range was completely stable. The monohydrate has a damping effect on the perchloric acid. N.E.A.

N64-22664 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATING LOW-SULFUR EXTRACTS OF SELECTIVE OIL PURIFICATION AND THE PRODUCT OF THEIR THERMAL CRACKING
V. I. Zavidov, Z. V. Fedorova, and N. I. Shapchenko 8 Jan. 1964 9 p Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 9, 1963 p 23–27
(FTD-TT-63-1152; AD-430241)

The possibility of using residual petroleum extracts as raw material for the production of active furnace carbon black was investigated. The chemical composition and properties of distillate raw petroleum extracts were studied after phenol purification, as well as properties of distillate and residual extracts (in a 1:1 ratio) from a mixture of journal and crankcase petroleum products. Research was also carried out on the product of thermal cracking of a mixture of residual extracts. P.V.E.

N64-22668 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTROSYNTHESIS OF OZONE FROM OXYGEN AT HIGH PRESSURES
I. A. Semiokhin, N. I. Kobozev, and Ye. N. Pitskhelauri 25 Mar. 1964 9 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., (USSR), Ser. II, Khimiya, no. 3, 1963 p 37–40
(FTD-TT-64-195/1+2+4; AD-435995)

The MGU-VD ozonizer was built for the electrosynthesis of ozone at elevated pressures. Electrosynthesis of low-concentration ozone (0.5% to 2%) is expediently carried out at P = 2 atm; the electrosynthesis of higher concentrations of ozone (greater than 8%) is more conveniently carried out at atmospheric pressure. The ozone formation rate was independent of pressure and varies with variation in electrical current. The ozone decomposition rate constant increased with increases in current and pressure. N.E.A.

N64-22688 Fairchild Camera and Instrument Corp., Syosset, N.Y. Fairchild Space and Defense Systems Div.
INVESTIGATION OF PANCHROMATIC SENSITIZATION OF EVAPORATED FILMS OF SILVER BROMIDE
James Lu Valle, Marvin Koral, and Asa Leifer 15 Jun. 1964 81 p
(Contract AF 33(657)-11105)
(AL-TDR-64-117; AD-601396)

This report deals with the preparation of panchromatically sensitized evaporated layers of silver bromide. The major factors controlling the evaporation of silver bromide, rate of movement of Cronar (substrate) past the boat, the temperature of evaporation, the shape of the boat, the distance from boat to substrate, and the relative location of boat and shield are discussed in detail. A thickness of 2μ to 3μ for the evaporated layers appears to optimize photographic sensitivity. Electron microscopic and electron diffraction studies have shown that the evaporated silver bromide is deposited as oriented crystals. Spectral sensitization of evaporated silver bromide may be obtained if the evaporated layer is etched prior to dye adsorption. The appendix consists of abstracts of 10 papers concerned with electron spin resonance spectra of dye-charge transfer complexes, the analysis of the infrared spectra of dye intermediates and of cyanine dyes, the synthesis of dye intermediates and of dyes, the possible role of excitons in latent image formation, and the possible role of exciton-exciton interactions in spectral sensitization. Author

N64-22708 Little (Arthur D.) Inc., Cambridge, Mass.
RESEARCH ON THERMODYNAMICS OF THE Al-B-O AND Be-B-O SYTEMS Quarterly Report, 1 Dec. 1963 – 29 Feb. 1964
Paul E. Blackburn [1964] 13 p refs
(ARPA Order 315-62)
(QR-7; AD-440415)

From measurements on the $BeO\text{-}B_2O_3$ system and mass spectrometric measurements on the beryllium rich portion of this system, values are computed for the heat of formation of $3BeO.B_2O_3(s)$ and $BeB_2O_4(g)$. The first two of a set of isothermal mensurations on the Al-B-O system were made and indicate that there are no stable mixed oxide compounds at or above 1,560° K. However, there do seem to be mixed oxides at 1,297° K. Under the conditions of the present experiments evaporation appears to be diffusion limited. Author

N64-22722 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J. Army Electronics Research and Development Labs.
THE COMPOSITIONAL ANALYSIS OF N COMPONENT SYSTEMS BY THE X-RAY ABSORPTION METHOD
Robert Lefker Apr. 1964 19 p refs
(USAELRDL-TR-2457; AD-601351)

A method has been devised for the compositional analysis of foil and liquid samples with n components ($n \geq 2$). The method requires that in an n component system, measurements of the linear absorption be made at n different wavelengths for the unknown, and for the n pure materials that constitute the unknown. With n measurements the thickness of the unknown is also determined. Matrix algebra is shown to be the necessary method of analysis when dealing with large numbers of components. Author

08 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation. *For tracking stations see*: 10 Facilities, Research and Support. *For related information see*: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation and Photography; and 22 Navigation and Guidance.

N64-21519 Colorado State U., Fort Collins
FEASIBILITY OF BALLOON TRAJECTORY ANALYSIS UTILIZING ANALYTICAL PHOTOGRAMMETRY Technical Paper No. 45, Part II
Robert V. Hayman and Jon A. Peterka 15 Jul. 1963 18 p refs
(Contract N-189(188)-55120A)
(CER63RWH31; NWRF-15-0364-091; AD-433123)

A study to determine if photogrammetric methods and equipment previously developed could be used for measuring trajectories of ground-released balloons for several miles into the air is reported. Resection orientation of tracking cameras is discussed along with associated field procedures. Limitations and problems include balloon visibility, camera angle of view, and rate of ascent. Recommendations include (1) using commercially available, accurate cinetheodolites; (2) photographing an illuminated object carried by the balloon at night, allowing stars to be used for space resection recovery of the camera attitude; and (3) simultaneously firing the companion cameras that are separated by the triangulation base-leg. The appendix includes a computer program, in FORTRAN II code, designed to solve, by spacial triangulation, for the location of any desired object that appears on each of two separate photographs. D.E.W.

N64-21529 Ling-Temco-Vought, Inc., Dallas, Tex. Aeronautics Div.
A STUDY OF NUCLEAR RADIATION EFFECTS ON TELEMETRY. VOLUME II: NUCLEAR RADIATION EFFECTS DESIGN ALLOWABLES
Ronald G. Stimmel Feb. 1964 301 p refs
(Contract AF 33(657)-11646)
(RTD-TDR-63-4287, vol. II; AD-433088)

Approximately 1,500 nuclear radiation effects "design allowables" on electronic materials and parts were compiled to provide a useful working tool for designing nuclear radiation-tolerant telemetry systems. The radiation effects design allowable is a nuclear radiation environmental exposure under which the associated material or part is expected to exhibit certain specified characteristic changes. The information presented does not include all available data, but is representative of the current technology of nuclear radiation effects. These data are an aid in performing nuclear-radiation effects analyses of telemetry systems and provide useful inputs for hardening such systems for use in a nuclear radiation environment. Author

N64-21536 Ling-Temco-Vought, Inc., Dallas, Tex. Astronautics Div.
A STUDY OF NUCLEAR RADIATION EFFECTS ON TELEMETRY, VOLUME I
Ronald G. Stimmel Feb. 1964 332 p refs
(Contract AF 33(657)-11646)
(RTD-TDR-63-4287, vol. I; AD-433087)

The primary objectives of this study were to: (1) define representative nuclear radiation environments in which telemetry circuitry may be required to operate; (2) establish the capability of off-the-shelf telemetry modules to operate properly in these environments; and (3) evolve certain criteria for the design of telemetry tolerant of nuclear radiation. The achievement of these objectives is discussed, and data are presented in tabular form. A.W.

N64-21547 California U., Berkeley
ON THE REFLECTION OF HARMONIC FUNCTIONS AND OF SOLUTIONS OF THE WAVE EQUATION ACROSS LINEAR DIFFERENTIAL BOUNDARY CONDITIONS
Vladimir I. Filippenko Oct. 1963 17 p refs
(Contract Nonr-222(62))
(AD-431974)

The analytic extension of a harmonic function across analytic differential boundary conditions is presented for the case of three independent variables, x, y, z. The formulation assumes that the boundary of reflection is the plane y = 0, and that the differential boundary condition is linear. J.R.C.

N64-21588 Lincoln Lab., Mass. Inst. of Tech., Lexington
RADAR BACKSCATTER FROM SOME LOW CROSS-SECTION SHAPES Group Report 1964-3
A. F. Smith 16 Jan. 1964 37 p refs
(Contract AF 19(628)-500)
(ESD-TDR-64-19; AD-431780)

Radar backscattering measurements have been made on four low cross-section shapes. Results indicate that little improvement is found over the return from a cone sphere. Comparison of measured data with approximate theoretical calculations shows fair agreement. Author

N64-21599 Mitre Corp., Bedford, Mass.
THE USE OF SATELLITES FOR CALIBRATION OF BMEWS RADARS
R. F. Shackford Feb 1964 16 p
(Contract AF 19(628)-2390)
(ESD-TDR-63-454; TM-3530; AD-431782)

Interest was recently expressed by the BMEWS Program Office in the possibility of using satellites on known orbits to calibrate the BMEWS radars. A method of doing this was investigated over a year ago with negative results. This document describes the method used and the results obtained, and includes as an appendix a report written by Dr. H. B. Wackernagel, who contributed extensively to the study. The work described was done several years ago, and shows why it was not then considered desirable to calibrate BMEWS target coordinate measurements on the basis of satellite observations. However, improvements in computer programs and input data necessitate a reevaluation of the conclusions contained herein. Author

N64-21600 White Sands Missile Range, N. Mex. Inter-Range Instrumentation Group
RADIO FREQUENCY PARAMETERS AND CRITERIA FOR INSTRUMENTATION TIMING
Jan. 1964 28 p
(IRIG-105-63; AD-431667)

To insure interference-free operation and efficient use of the radiofrequency spectrum at military test ranges, development of frequency parameters and criteria for design specifications of instrumentation timing, transmitting, and receiving systems is necessary. Parameters and criteria are proposed that are applicable to the standard timing formats devised by the Tele-Communications Working Group (TCWG) of the Inter-Range Instrumentation Group (IRIG). Four formats that will be transmitted by "open loop" radiofrequency radiation are used. The allocation of the five frequencies (139 to 143 mcs, Band #1) is based on the best geographical separation obtainable, and the use of Band #2 (1710 to 1850 mcs) is allocated to all ranges for local use. D.S.G.

N64-21625 Martin Co., Baltimore, Md. Electronic Systems and Products Div.
INTERFERENCE REDUCTION TECHNIQUES FOR NONLINEAR DEVICES Third Quarterly Progress Report, 1 Oct.-31 Dec. 1963

W. M. Rice and D. Lee Mar. 1964 28 p
(Contract DA-36-039-AMC-02200(E))
(ER-13171-2; AD-431892)

The nonlinearities that are determined from specifying a continuous band of harmonics have been investigated. Representative characteristics for one-port and two-port devices have been determined. Their behavior when subject to static changes in signal parameters has been calculated. The problems of the sensitivity of the output to variations of input signals and the distortion that would be introduced by such a device have been considered. Possible techniques to improve the device characteristics with respect to distortion and sensitivity are suggested. Author

N64-21653 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DESIGN OF ANTENNAS WITH COMPOUND EXCITER (Chapter III)
V. M. Ginzburg and I. N. Belova 13 Feb. 1963 36 p Transl. into ENGLISH from the book "Raschet Parabolicheskikh Antenn", Izd "Sovetskoye Radio", 1959 p 91–120
(FTD-TT-62-1520/1+2; AD-299850)

The calculation of radiation patterns of reflector antennas with quasi-point exciters is discussed in general. Subjects discussed in particular include the following: (1) a method for designing antennas with reduced near-minor lobes; (2) calculation of the radiation pattern of a mirror antenna with a one-point exciter; (3) calculation of the radiation pattern of a mirror antenna with an exciter composed of several point sources; (4) calculation of radiation patterns with reduced first-minor lobes; (5) calculation of the radiation pattern of an exciter consisting of discrete point sources; and (6) calculation of currents on a mirror surface. P.V.E.

N64-21655 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A MULTICHANNEL PHASE SYSTEM
V. G. Dolotov 24 Jan. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 145919, 18 Mar. 1961 1 p
(FTD-TT-62-1636/1+2+4; AD-298216)

The multichannel phase telemetry system described differs from other systems in its simplified circuit and increased reliability. A single-frequency master source (generator) of reference voltage is used in the receiving set, the output of which is connected to pulse-type phase meters equal in number to the number of the measurement frequency channels. The transmitter consists of static frequency multipliers. A.W.

N64-21664 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVICE FOR THE REPRODUCTION AND MEASUREMENT OF SHORT TIME INTERVALS, UMPV-2
27 Mar. 1964 4 p Transl. into ENGLISH from a Russian Publ. of the Comm. on Std., Meas., and Meas. Devices, Council of Min. of USSR, 1962, 1 p
(FTD-TT-64-4/1; AD-600486)

The device, which is known as the UMPV-2, is intended for testing apparatus that reproduce and measure small intervals of time. It consists of a test bed on which two electronic chronometers of KhE-2 type, a short-interval timer, and a ferroresonance voltage regulator are arranged. The UMPV-2 permits reproduction and measurement of time intervals in a range from 1μsec to 1 sec by degrees within 1μsec, and the upper limit of measurement is expanded to 10,000 sec as compared to 100 sec in earlier devices. The power supply and weight are reduced by a factor of 2. A.W.

N64-21669 Air Force Cambridge Research Labs., Bedford, Mass. Terrestrial Sciences Lab.
FEASIBILITY OF A LUNAR OPTICAL RANGING EXPERIMENT Research Report
Robert L. Iliff and Michael S. Tavenner Dec. 1963 24 p refs
(AFCRL-63-908; AD-434586)

A lunar ranging experiment using a high-energy pulsed laser is discussed giving special attention to the required minimum return signal, interfering radiation, detector devices, and pulse length. Author

N64-21694 Joint Publications Research Service, Washington, D.C.
PROGRAMMED INSTRUCTION AND CYBERNETIC TEACHING MACHINES
A. I. Shestakov, ed. 4 Jun. 1964 224 p refs Transl. into ENGLISH of a collection of articles "Programmirovanoye Obucheniye i Kiberneticheskiye Obuchayushchiye Mashiny", (Moscow), Izd. "Sovetskoye Radio", 1963 247 p
(JPRS-24933; OTS-64-31406) OTS: $3.50

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N64-21702 Deutsche Versuchsanstalt für Luft- und Raumfahrt Oberpfaffenhofen (W. Germany) Inst. für Flugfunk und Mikrowellen

THE INFLUENCE OF MULTIPLICATIVE NOISE ON THE DETERMINATION OF SIGNAL POSITION BY THE DOUBLE GATE METHOD [DER EINFLUSS MULTIPLIKATIVER STORUNGEN AUF DIE SIGNALLAGEBESTIMMUNG MIT HILFE DES DOPPELTORVERFAHRENS]

W. Fogy, C. Landgraf, and S. Starker Dec. 1963 93 p refs In GERMAN; ENGLISH Summary

(DVL-312) Available from DVLR, Porz-Wahn, W. Germany: DM 22.60

The signal power at the radar output depends on several factors as transmitted power, antenna characteristics, target cross section, receiver noise, and gain aso. Time fluctuations of one or of several of these factors, the most important of which is the cross section, are referred to as multiplicative noise. In the present paper, the influence of random multiplicative noise upon the position measurement accuracy of the double-gate method is investigated theoretically and compared with some experimental results. The double-gate method allows, with only one RF channel, a more precise measurement of the time position of a target signal if some a priori knowledge of the rough position is known. The deviation error of target position is described by its systematic and rms part, and by the 68.3-pc widths, are calculated for different double-gate parameters. In addition, the dependence of errors on signal-, gate-, and noise-parameters for out-of-zero deviation is described by simple approximation formulas. The connection with earlier measuring results gained during investigations of additive noise is briefly mentioned. Author

N64-21710 Electromagnetic Research Corp., College Park, Md.

PROCEDURES FOR ESTIMATING RADIO FIELDS PROPAGATED BY MULTIPLE SCATTERING IN THE TROPOSPHERE Final Report

N. S. Ament 31 Dec. 1963 95 p refs

(Contract AF 19(628)-272)

(CRL-272-4; AFCRL-64-128; AD-601108)

Tropospheric scatter propagation is considered as a multiple scatter process, the scattering being caused by irregularities of the dielectric structure. For simplicity, the atmosphere's statistical properties and its mean refractive index are assumed to depend on altitude only. Radio propagation in such an atmosphere is then considered from the point of view of ray theory. A Monte Carlo calculation, suitable for a fast digital computer, is outlined for computing the multiply scattered fields in a two-dimensional version of the problem. An adaptation is outlined for taking account of diffraction and weak ducting at the earth's curved surface. Further adaptations for estimating antenna performance, bandwidth, and azimuthal scattering are proposed. These considerations, and experimental evidence, lead to a statistical normal mode picture of the scatter field at far transhorizon ranges: the height-gain function and the statistics of the vertical slope components vary with range only through an exponential range-attenuation factor. Analytically prescribed atmospheric models, resembling atmospheres encountered in trade-wind inversion areas, are advanced, and features of the corresponding statistical normal mode are computed analytically. Author

N64-21720 Oklahoma State U. Research Foundation, Stillwater

SUPPORT OF THE UPPER AIR ROCKET RESEARCH PROGRAM Final Report

Claude M. Gwinn, Wayne Hoover, and Joe Zinn Jan. 1964 58 p refs

(Contract AF 19(604)-6648)

(AFCRL-64-195; AD-600269)

The components and assembly of compact portable FM–FM telemetry ground stations are described. The designs of both ground and airborne units associated with telemetry systems and the test and calibration of telemetry systems are presented. Some modifications made to commercially purchased items to extend their use for special applications are described. Systems for in-flight control of events through timers and ground command are described. Some studies and experiments on utilizing the telemetry to obtain the trajectories of rockets are discussed. An investigation of the state-of-the-art of UHF telemetry systems is discussed. Author

N64-21722 RAND Corp., Santa Monica, Calif.

REMOVING THE NOISE FROM THE QUANTIZATION PROCESS BY DITHERING: LINEARIZATION

G. G. Furman Feb. 1963 46 p refs

(Contract AF 49(638)-700; Proj. RAND)

(RM-3271-PR; AD-296598)

This memorandum treats the linearization of multistep quantizer nonlinearity by the application of independent quantizer activators called dithers. For the dithered quantizer acting in conjunction with a low-pass or band-pass filter, numerical answers are given for the first time to the questions: (1) What is the equivalent quantizer gain? (2) What upper bounds does the dither place upon the maximum deviation from linearity? (3) For given specifications, how is a dither amplitude determined so that the system is optimally dithered? Such information, with regard to two time-periodic dithers (the sinusoid and sawtooth), makes it possible to effect analog-to-digital-to-analog conversion with no apparent loss of information even when the quantization is rough. Author

N64-21737 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

UNITED KINGDOM TRACKING OF RUSSIAN SATELLITES BY RECEPTION OF THEIR 20 AND 40 MC/S TRANSMISSIONS

W. T. Blackband Jul. 1958 9 p Presented at the Rocket and Satellite Symp., 5th Reunion of the Comite Special Annee Geophys. Intern., Moscow, 30 Jul.–9 Aug. 1958

Because of cloudy weather during the autumn months, there was little opportunity for optical tracking in the U.K., and most of the information on orbits was provided by radio observation of the satellite transmissions at 20 and 40 mc/s, using Doppler and radio-interferometer equipment. This was supplemented by direction-finder observations and radar tracking. A net of Doppler stations was organized to provide a first estimate of the orbit. Once established, this orbit was studied with greater precision by Doppler stations at Banbury, Baldook, and Chelmsfor. In addition, observations were made from two 40 mc/s radio-interferometer sites, at Lasham and Cambridge. An interpretation of the Doppler measurements made is presented, and a crystal switch for radiointerferometers is described. R.T.K.

N64-21746 Ohio State U. Research Foundation, Columbus Antenna Lab.

ON THE DESIGN OF ONE-LAYER AND THREE-LAYER TUNABLE RADOMES Interim Engineering Report

Jack H. Richmond 15 Jan. 1964 23 p refs
(Contract AF 33(615)-1081)
(Rept.-1751-4; AD-433839)

Curves are presented for tunable radome sandwiches to show the manner in which the core permittivity must be varied to maintain maximum transmission at all times as the angle-of-incidence varies. Similar design data are also given for tunable half-wave radomes for which the required permittivity is independent of the polarization. In many cases only a slight tuning effect is needed to cover a large range of incidence angles. Author

N64-21752 Raytheon Co., Burlington, Mass. Spencer Lab.
ENGINEERING AND PRODUCTIZATION OF AN INTEGRATED FAMILY OF BACKWARD-WAVE OSCILLATORS, VOLUME ONE Final Report, 7 Jul. 1961–7 Jan. 1963
Peter Janis and James Gallagher Wright-Patterson AFB, Ohio, AF Mater. Lab., Oct. 1963 183 p
(Contract AF 33(600)-43395)
(ASD-TDR-63-7-695A; AD-431579)

A family of compatible M-type backward wave oscillator tubes, which can be tuned electronically, was developed. These tubes meet ASD requirements and passed stringent electrical, shock, vibration, thermal, and life tests. The tubes were designed to be mass produced at low cost. D.E.W.

N64-21778 University of Southern Calif., Los Angeles School of Engineering
SCATTER COMMUNICATION MODELS FOR SPACE VEHICLES Interim Technical Documentary Report
Robert A. Scholtz Jan. 1964 38 p refs
(Contract AF 04(695)-304)
(USCEE-104; SSD-TDR-64-59; AD-433717)

A basic problem in preventing the detection of space vehicles is the design of a communication link providing secure communications to deny vehicle location information for purposes of guidance or control, and telemetry. In many cases, for example ionospheric scatter or Needles-like scatter links, multipath channels are involved in the transmission of such information. The use of narrow beam antennas in illuminating the scatterers would make detection of space vehicle position difficult for hostile forces. However, communication over a multipath link is inherently a more difficult process than single path communication. Multipath communications are characterized by imperfect knowledge of signal waveforms when they arrive at a receiver. Under the assumption that this signal waveform is a sample function of a gaussian random process, a pulse-amplitude-modulation communication system is designed. Optimum receiver data processing and optimum message encoding procedures are derived as a function of the signal and additive noise statistics. When the mean of the pulse signal waveform at the receiver is zero, the optimum code is orthogonal. On the other hand, when the covariance function of the gaussian signal approaches zero, a regular simplex code provides optimum communications. Author

N64-21798 Stanford Research Inst., Menlo Park, Calif.
COMPARISON OF PRECIPITATION AND TROPOSPHERIC SCATTERING CROSS SECTIONS
F. G. Fernald and A. S. Dennis Jan. 1964 31 p refs
(Contract DA-36-039-SC-90859)
(TR-1; AD-434836)

This report provides a means of identifying cases where precipitation scatter becomes predominant on scatter links. Two scattering cross sections, that of gaseous components of the atmosphere and that of precipitation particles, if present, are derived as functions of path length, beamwidth, frequency, and weather conditions. Results for the case with both antennas directed at the horizon and uniform precipitation in the common volume are summarized on a nomogram for ease in comparing the two cross sections. Author

N64-21831 Technical Research Group, Inc., Melville, N.Y.
DEVELOPMENT OF A LOW-NOISE MILLIMETER-WAVE PARAMETRIC AMPLIFIER Second Quarterly Progress Report, 1 Oct. 1963–1 Jan. 1964
J. Kliphuis and D. Neuf Jan. 1964 30 p refs
(Contract DA-36-039-AMC-02365(E))
(Rept.-2; AD-434062)

The theoretical values of optimum noise temperature and gain-bandwidth product for a one-port nondegenerate parametric amplifier are derived under completely general conditions. A set of universal design curves showing the noise temperature and gain-bandwidth product as functions of the ratio of signal and idler frequencies (with the ratio of the diode figure of merit and the signal frequency as a parameter) are included. Measurements taken on the epitaxial GaAs junctions, packaged in ceramic cartridges, indicate that the self-resonant frequency of this configuration is too low for use in a 94-Gc amplifier. Various mounting configurations for the unpackaged junction are being evaluated. The results obtained from the Faraday-rotator-type isolator are encouraging. However, further improvements in performance will necessitate the solution of rather difficult mechanical problems. Consequently, the use of a Y-junction circulator is also being investigated. Author

N64-21856 Army Personnel Research Office, Washington, D.C.
INDIVIDUAL DIFFERENCES IN TRANSCRIBING VOICE RADIO MESSAGES EMBEDDED IN ATMOSPHERIC NOISE
A. E. Castelnovo, J. G. Tiedemann, and D. M. Skordahl Oct. 1963 18 p refs
(TRN-137; AD-432087)

Research effort that deals with voice radio messages embedded in atmospheric noise is discussed. The study was conducted to determine whether individuals show consistent differences in accuracy of transcription and whether any such differences are predictable by conventional measures. Voice-radio transcriber performance under low, medium, and high levels of atmospheric noise is analyzed. Prediction of performance by Army Classification Battery tests and effect of introduction of errors into transcript are examined. Pronounced individual differences in transcription were found, but differences were stable over time and across a broad range of noise intensity. Author

N64-21871 Michigan U., Ann Arbor Cooley Electronics Lab.
STUDY OF PHASE-SHIFT AMPLIFIER TECHNIQUES Report No. 4 (Final), Oct. 1, 1962–Sep. 30, 1963
D. K. Adams and J. L. Cockrell Mar. 1964 77 p refs
(Contract DA-36-039-AMC-00059(E))
(Rept.-05407-4-F; AD-434181)

The term phase-shift amplification is applied to the general process by which gain is obtained by mixing in two separate stages, one for up-conversion and the other for down-conversion. In this report, the optimum design of both of these stages is considered. Particular emphasis is given to the case where the first stage employs a varactor diode, but other devices are also considered. The phase-shift process is superior to other varactor techniques over a wide range of operating frequencies. Experimental results are reported on varactor phase-shift amplifier gain, bandwidth, noise figure, stability and dynamic range. One result of this work is an amplifier with 40-mc bandwidth, 13.5-db gain, 60-mc center frequency, 1.6-db noise

figure including later stages, and 80-db dynamic range. Complete procedures are given for designing phase-shift amplifiers for other center frequencies and bandwidths. The use of ferrite materials for phase-shift amplification was investigated. This approach is feasible but, as yet, it has not produced the high-gain bandwidth products that characterize varactor circuits. However, the work reported here shows the directions that future ferrite work must take to yield the desired phase-shift amplifier performances. A superregenerative phase detector with certain unique properties was developed and is particularly adaptable to binary signals. In addition, the analysis of this circuit demonstrated some interesting phase filtering effects useful for improving signal-to-noise ratios. Author

N64-21908 Electromagnetic Research Corp., College Park, Md.
SELECTION OF TERMINAL SITES FOR TRANSOCEANIC DUCT PROPAGATION MEASUREMENTS Final Report
M. Katzin 30 Sep. 1963 21 p refs
(Contract AF 19(628)-272)
(AFCRL-63-862; Pt. II; CRL-272-3; AD-601162)

In connection with a possible transoceanic duct propagation experiment across the Pacific, site surveys were made for terminals in California and Hawaii. Recommendations are submitted for transmitting and receiving terminal locations. Author

N64-21962 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RECIRCULATOR WITH QUANTIZATION
V. A. Fel'dman 12 Dec. 1963 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy Radiotekhn. (Kiev), no. 2, 1963 p 197–199
(FTD-TT-63-981/1+2; AD-426897)

This report discusses a recirculator with unlimited memory that memorizes arriving rectangular signals with an accuracy up to a certain value, called a quantum. The functional arrangement of the operational time diagram and the experimental ring circuit of the system are described. The recirculator with quantization can be used not only as a memory element, but also as a generator of complex periodic signals. N.E.A.

N64-21985 Radio Corp. of America, Camden, N.J. Communications Systems Div.
ACQUISITION AND TRACKING ANALYSIS FOR X-20 (DYNA-SOAR) COMMUNICATIONS AND TRACKING SUBSYSTEM
20 Mar. 1964 181 p refs
(Contract AF 33(657)-7134)
(CR-64-408-28-1; AD-434102)

An initial detection and acquisition study was conducted to determine the search capability of the X-20 communications and tracking subsystem. Handover studies were limited to designation errors in the ballistic regime. The basic modes of search in the present design are sinusoidal sector search, search lighting, and circle scan. A tracking study was made to determine the errors of the angle servos. It was found that the worst errors due to dynamic log for satellites or high-flying vehicles occur near zenith, and can be excessive enough to break track. The other predominant area for angle error is at low elevation angles where surface multipath conditions cause angle errors and modulation of the data carrier signal. R.T.K.

N64-21988 Electromagnetic Research Corp., College Park, Md.
THE COMMUNICATIONS POTENTIALITIES OF THE TRADE WIND INVERSION DUCT—ANALYSIS OF PROJECT NEPTUNE DATA, PART I Final Report
W. S. Ament, M. Katzin, and D. L. Ringwalt 31 Jul. 1963 157 p refs
(Contract AF 19(628)-272)
(CRL-272-2; AFCRL-63-862; AD-601163)

The analysis of propagation data for the trade wind duct shows that signals are strongly trapped and propagate with relatively low attenuation at the eastern end of the trade wind belt. At the western end the attenuation rate is higher, varying from day to day from relatively low values characteristic of duct propagation to values typical of classical tropospheric scatter propagation. The overall average of the measured attenuation rates for the entire path from Dakar to Puerto Rico was 8.9 db per 100 nmi. Height gain is definitely present at the eastern end of the trade wind belt. The optimum height is just below inversion level, and the magnitude of signal enhancement ranges from 5 to 20 db. Height gain usually is not evident at the western end of the trade wind belt. In particular, the signal above the duct remains relatively strong, so that a broad range of heights is suitable at this end of the path. From the analysis of fading rates, lower bounds for the signal power correlation of 900 ft horizontally and 60 ft vertically are deduced. Consequently, the full gain of antennas having such large apertures may be realized, and the bandwidth of the signal should be large. Since the fading rate is found to be roughly independent of distance, antenna gain and bandwidth should not diminish markedly with distance. Recommendations are given for additional experiments to refine the deductions from the data. Author

N64-22013 Brazil Comissao Nacional De Atividades Espaciais
ATMOSPHERIC NOISE MEASUREMENTS Data Summary No. 1
L. G. Meira and F. De Mendonca May 1964 28 p refs
(LAFE-13)

Work accomplished includes the transfer of the complete station from its early site, the repair of equipment, and collection of data. The general problem of radio-noise measurement is outlined, and the techniques and equipment used are described. Tables of month–hour values of radio noise for the period of August 1963 to December 1963 are presented. R.T.K.

N64-22015* General Dynamics/Electronics, Rochester, N.Y.
RESEARCH ON A MAGNETO-ACOUSTIC INFORMATION STORAGE SYSTEM
J. W. Gratian and R. W. Freytag Washington, NASA, Jun. 1964 93 p refs
(Contract NASw-592)
(NASA-CR-45) OTS: $2.25

Solid-state, nonvolatile, updatable storage and nondestructive readout are provided by the new delay-line information-storage technique that was studied. Its basic capability for sequential access to data tends toward the low cost, size, and weight per bit of information that characterize approaches using traveling storage media such as magnetic drums or tape, but the usual associated mechanical problems are entirely avoided. The technique uses the coincidence of a traveling strain pulse in the line, and a polarizing-field pulse applied to an axial conductor, to accomplish writein at any prescribed address. Subsequent ultrasonic pulses cause a readout voltage to be induced in the central conductor as they propagate through previously recorded regions. Study of storage material properties and transducer requirements resulted in the demonstration of operation with 1-μs pulses using commercial, unoriented, 51% NiFe tubing having an OD of 15 mils and a wall thickness of 2 mils. The advantages of piezoelectric transducers, however, outweighed their constructional disadvantages for operation with pulses of the order of 1 μs and less. Author

N64-22158 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINING THE SITE OF TRANSMITTERS FOR USW AND MICROWAVE RADIO COMMUNICATIONS WITH THE AID OF A TERRAIN MODEL, PART II
H. Weihrauch 6 Apr. 1964 15 p Transl. into ENGLISH from Nachrichtentechnik (E. Berlin), no. 3, 1963 p 111–114
(FTD-TT-64-30/1+2; AD-600615)

The following are discussed: (1) taking diffraction on the curvature of the earth into consideration in evaluation of the model; (2) evaluation of the illumination of the surface of the relief; (3) the influence of the condition of the surface of the model of the results; and (4) realization of the light-distribution function. P.V.E.

N64-22162 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF SIGNAL SHAPE ON ITS DETECTION UNDER NORMAL CORRELATED NOISE
V. F. Nesmeruk 11 May 1964 14 p refs Transl. into ENGLISH from Radiotekh. i Elektron. (Moscow), v. 8, no. 8, 1963 p 1319–1325
(FTD-TT-64-439/1+4; AD-600604)

This paper examines the problem of optimal detection of a signal, yielding the maximum probability of detection during correlated noises. An example is given of Markovian noise. Author

N64-22196 Stanford Research Inst., Menlo Park, Calif.
HF COMMUNICATION EFFECTS SIMULATION: INSTRUMENTATION AND OPERATION OF THE FIELD EXPERIMENT Interim Report No. 3
R. A. Shepherd Dec. 1963 101 p
(Contract DA-36-039-SC-87197)
(AD-434554)

The field-test phase of the experiment consists of an examination of six propagation paths, some of which pass through the auroral zone and some of which are south of the zone. These six paths are examined with oblique-incidence ionosphere sounders that collect propagation data between 4 and 64 mc. Two of the paths are also studied using a phase-stable CW system for the measurement of phase and amplitude of propagated signals. The primary equipment used in the experiment, consisting of ionosphere sounders and of a phase-stable CW system, is described. Author

N64-22248 ITT Federal Labs., Nutley, N.J.
APPLIED RESEARCH STUDY ON SATELLITE COMMUNICATIONS. VOLUME 2
D. Campbell, M. Epstein, E. Pflumm, P. Cheilik, A. Werth et al [1963] 164 p refs
(Contract DA-36-039-SC-90886)
(QPR-4; AD-433884)

Progress is reported in the following areas: (1) antijam techniques; (2) communication control channel; (3) reliability; (4) traffic routing techniques; (5) multiple access techniques; and (6) mobile ground stations. Author

N64-22277 Michigan U., Ann Arbor Electron Physics Lab.
INVESTIGATION OF LARGE-SIGNAL TRAVELING-WAVE TUBES Quarterly Progress Report No. 6, 1 Oct.–31 Dec. 1963
G. T. Konrad and J. E. Rowe Griffiss AFB, N.Y., RADC, Apr. 1964 63 p refs
(Contract AF 30(602)-2834)
(RADC-TDR-64-108; AD-600837)

The two-dimensional analysis for large signal phenomena in traveling-wave devices and klystrons has been employed to obtain solutions to drift-space interaction phenomena. The velocity components and harmonic current components within an electron stream are presented. The nonlinear theory for the solution of large-signal phenomena in microwave devices by a density function method has been checked. The Langmuir diode has been used as a test case. The agreement with the known results for this geometry is excellent. The work on a tube using a helix-type slow-wave circuit with two successive step changes in the phase velocity near the output end of the tube is described. Cold test data on the ring-and-bar tube in the presence of a conducting shield around the slow-wave circuit have been obtained. These results are presented in detail in the form of a series of curves. Author

N64-22287 Illinois U., Urbana Electrical Engineering Research Lab.
ON MAXIMIZING THE SIGNAL-TO-NOISE RATIO OF A LINEAR RECEIVING ANTENNA ARRAY
Robert H. Mac Phie Jan. 1963 48 p refs
(Contract AF 33(657)-10474)
(TR-65; AD-298281)

The problem of supergaining an antenna is equivalent to that of maximizing the signal-to-noise ratio when the noise distribution is uniform and incoherent. In addition to the continuous aperture, the case of the optimum array is considered, and an exact solution is obtained for the optimum weighting coefficients of the array elements. The analysis is valid for any type of noise distribution including a totally coherent one. However, the special case of an incoherent distribution is dealt with separately and leads to a simpler solution. J.R.C.

N64-22289 Library of Congress, Washington, D.C. Aerospace Information Div.
SURVEY OF SOVIET-BLOC SCIENTIFIC AND TECHNICAL LITERATURE. TRACKING OF MISSILES AND SPACE VEHICLES. COMPILATION OF ABSTRACTS AID Work Assignment No. 12, Report No. 21
22 May 1964 40 p refs
(AID-P-64-36; AD-600656)

This bibliography covers the following topics: (1) electromagnetic problems; (2) ion clouds and ionosphere perturbations; and (3) radio astronomy—radio emission and antennas, and quantum molecular oscillators. P.V.E.

N64-22302 Technical Research Group, Inc., East Boston, Mass.
EFFICIENT FLUSHMOUNTED SURFACE WAVE LAUNCHER Scientific Report No. 4
Mats E. Viggh 28 Nov. 1962 87 p refs
(Contract AF 19(604)-8057)
(AFCRL-63-63; AD-406632)

Various methods for launching surface waves are reviewed, and the basic design principles are outlined for different kinds of launchers. The case of a slot in a dielectric-clad groundplane is analyzed in detail, and experiments supporting the calculated results are reported. A way of combining several slots for good launching efficiency is derived, and a five-slot launcher designed after this principle is described. Results from measurements of radiation patterns and efficiency are reported, as well as from measurements of radiation patterns from discontinuities on a surface waveguide excited by this launcher in combination with a cylindrical parabolic reflector. In particular, a launching efficiency of over 80% was achieved with five slots, as compared to about 48% with one slot. Radiation patterns due to abrupt changes in dielectric

thickness were measured, and compared with theoretical results for a corresponding change in surface reactance. The agreement was good at least within the main lobe. Author

N64-22321 Aerospace Corp., El Segundo, Calif. Electronics Div.
THE DETECTABILITY OF DISCRETELY MODULATED CARRIERS
David J. Braverman Mar. 1964 32 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-34; TDR-269(4111)-11; AD-600983)

This report deals with the detectability of biphase modulation, symmetrically filtered biphase modulation, and quadriphase modulation. The results provide a guide to the detectability of other types of discrete modulation, such as amplitude modulation of M-ary phase modulation. The analysis presents output carrier-to-noise ratio in terms of input signal-to-noise ratio and receiver bandwidth ratio. Author

N64-22322 Aerospace Corp., El Segundo, Calif. Tracking and Radar Dept.
BREAKDOWN IN WAVEGUIDES DUE TO THE MULTIPACTOR EFFECT
H. M. Wachowski May 1964 47 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-77; TDR-269(9990)-5; AD-601069)

This report presents the theory of the multipactor effect and applies it to the problem of transmitting high power levels through waveguides operating at low gas pressures. The multipactor effect is a secondary electron resonance phenomenon. As such, it can occur only for certain combinations of operating conditions. Charts are presented showing the operating conditions that lead to the multipactor effect in its various modes. It is shown that only the high order breakdown modes are of concern for ordinary waveguide operation, and that breakdown in the higher order modes is possible only for certain very restricted ranges of peak voltage. Therefore, it is quite unlikely that multipactor breakdown will actually occur in an ordinary rectangular waveguide. Author

N64-22377 National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
NUMERICAL EVALUATION OF AN APERTURE-SYNTHESIS METHOD OF MEASURING MULTIPATH FIELD COMPONENTS Technical Note No. 8
Charles O. Stearns and Mary E. Chrisman 8 May 1964 74 p refs
(Contract AF 30(602)-2385)
(NBS-8275; RADC-TDR-63-550; AD-441582)

An aperture-synthesis method of measuring multipath field components is evaluated by generating simulated measured amplitudes and phases of the field taken at $\lambda/2$ intervals along 3 orthogonal axes and for 3 orthogonal antenna polarizations with an aperture length of 10λ. The simulated values are generated with 7-figure accuracy by assuming amplitude, phase, and angle of arrival with respect to the axis of measurement for 4 multipath components. From these values, 6 quantities are computed. They are the amplitude and relative phase of both the horizontal and vertical field component and the azimuthal and elevation angles of arrival. Computations were performed assuming 10 components with the generated data rounded to 2 significant figures, since this is near the accuracy obtainable in practice. Tests were made to determine the dynamic range, the angular resolution, the effect of letting the phase approach zero, and the effect of on-axis angles of arrival. Results were obtained with a maximum absolute error of 0.11 v/m for the normalized amplitude, 19.0° for the phase, and 1.5° for the angle of arrival. The tests were successful over a 20-db range, for 5.0° angular resolution, for phase ranging to 0.0°, and for on-axis angles of arrival. Author

N64-22379 Aerospace Corp., El Segundo, Calif. Satellite Control Office
ANALYSIS OF ACOUSTICAL PROBLEMS AT THE SATELLITE CONTROL FACILITY
C. S. Hoff 20 Apr. 1964 51 p ref
(Contract AF 04(695)-269)
(SSD-TDR-63-239; TDR-269(4110-01)-10; AD-600576)

The results of this analysis indicate that the sound environment in the SCF is sufficiently severe to threaten the operational effectiveness of the network. The most severe sound exposures are potentially damaging to human hearing. The least severe exposures interfere with essential voice communication. Critical noise problems in the SCF and acoustical criteria for operating areas are given. Some noise reduction measures are presented. Author

N64-22387 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROPAGATION OF RADIO WAVES
N. P. Dolukhanov 15 Feb. 1963 502 p refs Transl. into ENGLISH from the book "Rasprostraneniye Radiovoln" Moscow, Gos. Izd. Lit. Po Vopr. Svyazi i Radio, 1960 p 1–391
(FTD-TT-62-582/1+2; AD-297561)

This textbook begins with basic definitions and statements of general questions of radio propagation, and then, in detail, it covers: (1) the propagation of radio ground waves; (2) the effect of the troposphere on ground-wave propagation conditions; (3) the structure of the ionosphere and radio-wave propagation in the ionosphere; (4) propagation of long and very long ionosphere waves; and (5) atmospheric and cosmic radio noise. D.E.W.

N64-22442* Ohio State U., Columbus Antenna Lab.
ON THE CORRELATION RADIOMETER TECHNIQUE
K. Fujimoto Repr. from IEEE Trans. Microwave Theory Tech., v. MTT-12, no. 2, Mar. 1964 p 203–212 refs
(Grant NsG-74-60)

The correlation radiometer is a system in which two antenna-receiver systems are employed, the outputs of the two systems being correlated electronically. This paper studies the two basic types of correlation radiometers, the intermediate-frequency correlation (IF) type and the video-frequency correlation (ENV) type. The SNR's, the minimum detectable temperature sensitivities, the effects of receiver gain and phase fluctuations, and the uses of the two types are studied. A comparison of the various characteristics of the two types of correlation radiometers with the same characteristics of the Dicke-type radiometer is made. Author

N64-22447* Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
DEEP SPACE OPTICAL COMMUNICATIONS SYSTEMS STUDY Final Report, 7 Nov. 1962–15 Aug. 1963
Kenneth L. Brinkman, V. George, J. Callis, M. Rensink, B. Lengyel et al Aug. 1963 228 p refs
(Contract NAS9-879)
(NASA-CR-56466; SSD-3473R)

The following areas are discussed: (1) problems in the practical utilization of optical detectors in a laser communication system; (2) the characterization of the operating properties of numerous lasers (pulsed and CW, gas–liquid, solid-state, and semiconductor lasers with optical, electrical, and other types of pumping systems); (3) the statistical nature of

the noise from the various lasers (i.e., coherence and stability properties); (4) various types of modulation systems that might be implemented; (5) various physical devices and their utilization in light modulation (estimates of the modulator power required, the percent of modulation and distortion, and systems limitations are indicated); (6) various demodulation systems and a comparison between them, theoretically, for the purpose of establishing a performance characterization as a function of frequency, bandwidth, and external noise; (7) characterization of the information channel by presenting the effects of attenuation and external noise sources on system performance; (8) earlier interim reports concerning operations analysis with emphasis on energy sources, tracking and pointing accuracy, and stabilization; (9) systems analysis and the establishment of the optimum operating frequency selection and the source–destination selection; and (10) the preliminary design of a PCM polarization modulation system. I.v.L.

N64-22454* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
NOISE PERFORMANCE OF TRAVELING-WAVE MASERS
W. H. Higa Repr. from IEEE Trans. on Microwave Theory and Tech., v. MTT-12, no. 1, Jan. 1964 2 p ref
(Contract NAS7-100)
(NASA-CR-56283; JPL-TR-32-506)

A review of the noise performance of traveling-wave masers (TWM) is given. It is shown that when the gain per unit length of structure is low, the equivalent noise temperature of the TWM can become appreciable. The discussion indicates the need for careful design of a TWM when operating at elevated temperatures (4.2° K or higher), which the present state-of-the-art of closed-cycle refrigerators requires. R.T.K.

N64-22475 Melpar, Inc., Falls Church, Va.
LONG RANGE COMMUNICATIONS INTERFERENCE STUDY: INVESTIGATION OF THE FRESNEL REGION OF A CASSEGRAIN ANTENNA Technical Note
Dougal W. S. Prins Feb. 1963 35 p refs
(Contract AF 20(602)-2528)
(RADC-TDR-62-360, Vol. II; AD-296905)

A theoretical and experimental investigation of the electromagnetic field in the Fresnel region of a Cassegrain antenna was conducted. Good agreement of experiment and theory was obtained near the beam axis. The most significant off-axis radiation was found to be due to forward spillover from the subreflector. The magnitude of mutual coupling of two Cassegrain antennas through this forward spillover as a function of separation distance is estimated, and methods of reducing the spillover recommended. Author

N64-22477* Illinois U., Urbana Antenna Lab.
RADIATION FIELD OF AN ARBITRARY ANTENNA IN A MAGNETOPLASMA
George A. Deschamps and O. Kesler [1963] 12 p refs Submitted for Publication
(Grant NsG-395)
(NASA-CR-56291) OTS: $1.60 ph

The problem of finding the far field of an antenna in a magnetoplasma such as the ionosphere is solved in a simple manner, and the results are expressed in terms of the normalized characteristic plane waves of the medium. The results show how the far field depends on the free-space pattern of the antenna, on the shape of the dispersion surface, and on the polarization of the characteristic waves. In the derivation, use is made of the magnetic field instead of the electric field. P.V.E.

N64-22492 Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
INTRODUCTION TO PULSE COMPRESSION, PART I
A. W. Rihaczek 21 Apr. 1963 117 p refs
(Contract AF 04(695)-169)
(TDR-169(3250-43)TN-1; SSD-TDR-63-58; AD-436736)

This report analyzes the principles of pulse compression and discusses their significance in the context of radar measurements in general. The study is in the nature of a survey, and its primary aim is to provide orientation. Author

N64-22525 Bell Telephone Labs., Inc., Whippany, N.J.
AIRBORNE COMMUNICATION SYSTEM. MARCOM RELAY, PHASE I Final Report, Sep. 15, 1963 – Jun. 1, 1964
[1964] 68 p
(Contract DA-36-039-SC-89250)
(Rept.-6; AD-600841)

The main purpose of the test program was to gather basic data on air-to-air and ground-to-air propagation in the 4,400- to 5,000-mc frequency band. The multichannel communication system for the first aircraft was completed. Selection of ground-station transmitting sites for the ground-to-air tests was started. Procedures for handling raw data, manual processing, and machine processing are described. Transmission capabilities, antenna, and radio equipment results are included R.T.K.

N64-22527 White Sands Missile Range, N. Mex. Inter-Range Instrumentation Group of the Range Commanders Conference
IRIG STANDARD COORDINATE SYSTEM AND DATA FORMAT FOR ANTENNA PATTERNS
Apr. 1963 49 p refs
(IRIG-102-61; AD-266697)

This document defines (1) a vehicle-antenna coordinate system and (2) antenna pattern formats recommended for use at the National and Service Ranges. Antenna polarization considerations, a sample analysis of a contour antenna pattern, and a number of definitions associated with vehicle antenna pattern representation are presented. Author

N64-22528 Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
ELECTROMAGNETIC MEASUREMENTS DURING THE BANSHEE SERIES
Clyde B. Dobbie and Charles S. Fitzgerald 30 Dec. 1963 22 p
(Contract DA-49-146-XZ-092)
(B-2703; DASA-1451; AD-600665)

Electromagnetic (EM) monitoring systems were assembled and operated during a portion of the BANSHEE test series to record the EM signals resulting from the detonations and to correlate these EM data with the photographic record of the fireball growth rate, in an attempt to validate the "magnetic bubble" EM generation theory. Each of the two EM monitoring systems, which had been operationally checked during the pre-BANSHEE detonation, consisted of three mutually orthogonal loop antennas, low level amplifiers and matching networks, and multichannel tape recorders. No discernible EM signals from the monitored detonations have been found in an analysis of the records of those events. Author

N64-22547 Dayton U., Ohio Research Inst.
THEORETICAL AND EXPERIMENTAL REFLECTION FROM DIFFERENT REFLECTING BODIES IN THE FAR FIELD AND LASER BEAM MEASUREMENTS WITH RESPECT TO INTENSITY AND TIME Interim Report

Werner Rambauske, Ronald R. Gruenzel, and Michael K. Barnoski Jun. 1963 91 p
(Contract AF 33(657)-9014)
(AD-423641)

This paper reports how classical laws of Lambertian reflection were applied to the reflection problem of the standard geometrical bodies, and how equations were derived that are valid for the far field (indefinite distance). Numerical solutions of these equations are plotted and shown in a set of curves. Likewise, a far-field situation was simulated in a photometric cavity, and the series was repeated under great care and accuracy. The received curves were strikingly similar to the theoretical ones, indicating that both theoretical and experimental solutions are correct. N.E.A.

N64-22555 General Dynamics/Fort Worth, Tex.
A THEORETICAL ANALYSIS AND EXPERIMENTAL RESULTS OF A FREQUENCY STEPPING METHOD FOR RADAR SCATTERING MEASUREMENTS
J. W. Tucker, J. W. Jones, C. H. Fletcher, and W. P. Cahill Griffiss AFB, N.Y., RADC, Mar. 1964 117 p refs
(Contract AF 30(602)-2831)
(FZE-222-3; RADC-TDR-64-150; AD-601387)

When a large, complex target is rotated to obtain a radar cross section (RCS) pattern, the observed RCS typically exhibits violent oscillations. These oscillations are characteristic of the changing relative phase between reflections from individual scatterers as the target rotates. Significant RCS data may be obscured by the oscillations. These oscillations may be smoothed by using a frequency-stepping technique in which the radar frequency is shifted from pulse to pulse. The result is an RCS pattern in which the characteristics of individual scatterers are emphasized rather than the interactions between the scatterers. An ancillary result of the frequency-stepping technique is that it may be used to obtain greatly improved range resolution. This capability arises as a direct consequence of the wide bandwidth of the frequency stepping waveform. Instrumentation requirements include a stairstep voltage waveform generator, a voltage-tuned oscillator, a narrow-band filter, and a moving corner reflector. Author

N64-22563 Case Inst. of Tech., Cleveland, Ohio Systems Research Center
AN ELEMENTARY INFORMATION PROCESSOR FOR OBJECT RECOGNITION
James C. Pennypacker May 1963 121 p refs
(Grants AF-AFOSR-125-63; NSF GP-658)
(SRC-30-1-63-1; AD-601749)

A concept is defined to be a class of objects whose members can be distinguished by processing its properties. A property is defined to mean a partition of the set of all objects into disjoint classes. The concept is described by a conception, which is a list structure. The conception of a concept is built up from elementary conceptions by a recursive process. A processor, which consists of a series of computer flow charts, is described. The processor is capable of forming conceptions of known and new concepts and is capable of processing information relevant to these concepts. In addition, the processor is capable of elementary learning. Author

N64-22569 Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
DIGITAL PROCESSING EQUIPMENT FOR THE SPACE RADIO SYSTEMS FACILITY AND ITS UTILIZATION
R. N. Geddes 2 Jun. 1964 66 p
(Contract AF 04(695)-269)
(SSD-TDR-64-40; TDR-269(4250-41)-2; AD-601398)

This equipment has been programed to position the millimeter wave antenna to an overall pointing accuracy of 20 sec of arc. The antenna servoloop has been closed through the digital computer, and various modes of automatic antenna positioning and preliminary data reduction have been incorporated into the processing equipment. Author

N64-22611 Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
A MONOPOLE PHASED-ARRAY FEED FOR SPHERICAL REFLECTORS Instrumentation Papers No. 37
W. G. Mavroides and L. S. Dorr Apr. 1964 18 p
(AFCRL-64-291; AD-441460)

A line source array has been designed and built to illuminate a spherical reflector 500 ft in diameter. The spherical aberration is corrected by controlling the phase along the line source by uniformly spaced cylindrical posts (periodic structure) and by varying the width of the waveguide along the course. The amplitude of the radiation from the line source is controlled by probe-coupled monopoles. Design, test procedure, and results at 2,840 mc are presented. Author

N64-22624 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DIRECTIONAL RADIO ANTENNAS
13 Feb. 1963 12 p Transl. into ENGLISH from Fernseh und Nachrichtentech., VEB Rafena Werke Radeberg (E. Germany) p 1-9
(FTD-TT-62-1426/1+2+3+4; AD-401597)

Directional radio antennas used for transmission and reception of radio signals at very high frequencies are discussed. Through the directional action, a greater portion of the radiated energy reaches the receiver; thereby, either a great distance is bridged or, at a given distance, the quality of the transmission is improved, since the higher signal level at the receiver effectively suppresses noise and fading. In addition, beaming of radio rays produces directional selectivity; the hazard of disturbances from adjacent lines is lessened, and better utilization of available frequencies is possible. J.L.D.

N64-22666 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COAXIAL DOUBLE-SLOTTED MEASURING LINE
28 Feb. 1964 4 p Transl. into ENGLISH from Kom. Standartov, Mer i Izmeritel'nykh Priborov Pri Sovete Ministrov (USSR), 1962 p 1
(FTD-TT-64-6/1; AD-435508)

The coaxial double-slotted measuring line is intended for the measurement of a voltage standing wave ratio (VSWR) and the impedances of coaxial loads. It consists of a section of coaxial line with two longitudinal slots in the external conductor, which are symmetrically located relative to the axis of the conductor in the diametric plane. A probe is lead into each slot. Both probes, symmetrically located relative to the internal conductor of the coaxial, excite one coaxial resonator, which is coaxially located with the basic coaxial and moves along its surface as on a guide. Application of the double probe allows for the exclusion of a basic component of error that is due to an imbalance of the carriage movement and an eccentricity of the internal line conductor, and also discards the supporting washer from the side of the switched-in load, which lowers the fundamental VSWR of the device. The margin of error in the measurement of VSWR is 2.5%. Author

N64-22669* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAVELING WAVE TUBE RE-ENTRANT AMPLIFIER SERRODYNE SYSTEM
W. K. Allen, L. J. Ippolito, and D. A. Nace Jun. 1964 21 p
(NASA-TN-D-2149) OTS: $0.75

Communication satellite transponders can be simplified by using a traveling wave tube (TWT) in a reentrant mode for frequency conversion and amplification. Frequency conversion can be accomplished either by using a crystal RF mixing scheme in the reentrant loop or by serrodyning the TWT. The crystal mixing method is straightforward for a 2kmc conversion whereas the serrodyning technique is not. A serrodyned TWT system would eliminate the losses associated with crystal mixing as well as one of the rejection filters in the reentrant loop. In serrodyning, the TWT helix is modulated with a linear sawtooth, adjusted to deviate the phase (tube transit time delay) $2N\pi$ radians, so that all but one of the first sidebands are suppressed and displaced by N times the fundamental modulating frequency. The upper limitation on the serrodyne frequency, linearity, and intermodulation distortion is controlled by the inherent TWT characteristics, namely the helix, and by the sawtooth generator. The rejection of the reentrant loop bandpass filters establishes the required TWT rejection characteristics and vice versa. The Q of the rejection filters is inversely proportional to the bandwidth and the skirt-bandwidth should be no more than twice the information bandwidth. The stability of the TWT reentrant serrodyne system is also governed by the power supply versus the TWT characteristics. The noise figure for the reentrant TWT can be obtained by considering the reentrant loop as a system of two cascaded amplifiers with filters interposed between. Author

N64-22670* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A 1200 FOOT ENDLESS-LOOP TAPE TRANSPORT FOR SATELLITE APPLICATIONS
Kenneth W. Stark Washington, NASA, Jun. 1964 21 p
(NASA-TN-D-2316) OTS: $0.75

The tape-recorder development described is a low power, two-speed recorder whose unique endless-loop cartridge stores 1,200 ft of 1/4 in.-wide lubricated magnetic tape. A maximum mechanical power of 1.29 w is required to drive the transport at 30 ips at 0° C. During operation in the record mode at 3 3/4-ips tape speed only 0.083 w of mechanical power is required at 0° C to operate the transport. Speed reductions are obtained through the use of accurately machined pulleys and seamless polyester film belts. Although the optimum motor was not obtained at this writing, wow and flutter measurements were obtained at 1.14% p-p from 0 to 1,000 cps bandwidth. Included in this report is a discussion on the problems that arose with the tape during tests and the resultant solutions. The exceptional performance is made possible by the use of the unique tape cartridge and the accurately machined capstan assemblies, which have less than 50×10^{-6} in. total indicated runouts. Duplex preloaded bearings are utilized throughout the transport. The mechanical portions of this transport have survived sinusoidal vibrations at 10 g from 5 to 2,000 cps for 18 min and random vibrations at 20 g rms from 20 to 2,000 cps for 4 min. Author

N64-22671* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EFFICIENT PCM ERROR CORRECTION AND SYNCHRONIZATION CODE
Marvin S. Maxwell and Richard L. Kutz Washington, NASA, Jun. 1964 18 p ref
(NASA-TN-D-2317) OTS: $0.50

An efficient method of frame synchronization and error correction is analyzed. The probability of frame synchronization as a function of single bit error probability is shown. Additional error correction information may be obtained if the voltage from the bit integrator is used with an error detecting code. The equivalent gain in signal-to-noise ratio, made by using the additional error-correction method, is discussed. On the basis of this analysis, a ground station is proposed to process data by using these error-correction techniques. Author

N64-22690 Illinois U., Urbana Antenna Lab.
THE GENERALIZED SCATTERING MATRIX ANALYSIS OF WAVEGUIDE DISCONTINUITY PROBLEMS Technical Report No. 1
James R. Pace Apr. 1964 86 p refs
(Contract AF 19(628)-3819)
(AFCRL-64-290; AD-601131)

Three boundary value problems involving discontinuities in a parallel plate waveguide are solved. The three kinds of waveguide discontinuities studied are the metallic step discontinuity, the inhomogeneous E-plane bifurcation, and the trifurcation. The generalized scattering matrix technique, introduced by Mittra and Pace, is applied to solve these problems. The solutions obtained are formally exact and in series form. No restriction is made on the operating frequency of the waveguide. The solutions are equally valid for oversized waveguides, in which several modes are allowed to propagate down the guide at once. The results of numerical computations of the reflection coefficient for the dominant mode in the waveguide are reported. The computations were performed on a digital computer. Where possible, the author's results are compared with those published by Marcuvitz, Williams, and Cronson. Close agreement between the author's results and those of the above authors is noted. Author

N64-22701 Stanford U., Calif. Microwave Lab.
AN ANALYSIS OF ORBIT PUMPING PHENOMENA IN QUADRUPOLES
T. Wessel-Berg Griffiss AFB, N.Y., RADC, May 1964 38 p refs
(Contract AF 30(602)-2575)
(RADC-TDR-64-82; AD-601191)

The conditions for orbit pumping in quadrupoles are evaluated by a rigorous perturbation analysis. The orbits are perturbed for pump frequencies in four specified regions near $2\omega'$, $2\omega''$, ω_c, and zero. However, orbit pumping in the sense of exponential instabilities is limited to pump frequencies near $2\omega'$, $2\omega''$, and zero. Orbit pumping thresholds are presented for a variety of conditions. Comparison of orbit pumping for the cyclotron wave parametric amplifier (the Adler tube) and the synchronous wave d.c. -pumped amplifier shows larger susceptibility to orbit pumping for the latter. Depending on the d.c. space charge in the beam, the threshold for the d.c.-pumped amplifier is lower by a factor of two to four, measured in decibels. Author

N64-22714 Illinois U., Urbana Electrical Engineering Res. Lab.
RESEARCH STUDIES ON PROBLEMS RELATED TO ANTENNAS Quarterly Progress Report, 1 Dec. 1963–29 Feb. 1964
James Rippin Apr. 1964 51 p refs
(Contract AF 33(657)-10474)
(QPR-6; AD-601586)

Investigations having the following purposes are summarized: (1) explaining the observed properties of log-periodic

antennas; (2) development of a log-periodic array of cavity-backed slots that will produce vertically polarized radiation without projecting above the ground plane; (3) obtaining design information about a class of periodic and log-periodic leaky wave structures having potentially high gain, frequency independent antennas; (4) feasibility of using varactor diodes in a backfire antenna to produce amplification in the antenna itself; (5) calculation of the complete k-β diagram (Brillouin diagram) for various helical structures; (6) study of periodic structures for wideband applications; (7) study new types of log-periodic (triangular tooth) antennas; (8) developing a high resolution millimeter antenna by coupling from a Goubau beam-waveguide to a radiating lens; (9) determine the fields radiated by oversize circular waveguides propagating in circularly symmetric modes and their use as millimeter antennas; (10) development of both omnidirectional and steerable beam antennas operating at millimeter wavelengths. P.V.E.

09 ELECTRONICS

Includes circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory. *For related information see*: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation and Photography; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N64-21524 Tung-Sol Electric, Inc., Livingston, N.J. Chatham Electronics Div.
PRODUCTION ENGINEERING MEASURE FOR TYPE 7890 SUPER POWER HYDROGEN THYRATRON Sixth Quarterly Progress Report, 8 Jun.–7 Sep. 1963
C. L. Shockelford [1963] 26 p
(Contract DA-36-039-SC-85984)
(Rept.-6; AD-432211)

Two 7890-type tubes were assembled, and one other tube was exhausted with the result that testing was limited to initial and life tests on one completed tube. The life test performed on the completed tube was not completely conclusive because of the necessity of additional cooling to prevent excessive grid distortion. However, a need for greater increased reservoir capacity was indicated by the life testing. A new construction problem was encountered in the presence of blowholes in a braze in the envelope of one of the assembled tubes that could not be vacuum sealed. P.V.E.

N64-21525 Cornell U., Ithaca, N.Y. School of Electrical Engineering
OPTIMIZATION OF POLE SENSITIVITY IN ACTIVE RC NETWORKS Technical Report No. 77
N. M. Herbst 15 Dec. 1963 89 p refs
(Contract DA-36-039-AMC-00034(E))
(EE-569; AD-433287)

The sensitivity of active RC networks with respect to variations in the gain of active elements is studied by means of the zeros of the pole-sensitivity function. It is demonstrated that the zeros of sensitivity indicate the effect of the polynomial decomposition of a synthesis procedure upon the pole sensitivity. Methods of realizing network functions with prescribed decompositions are discussed, and several specific networks are given. Author

N64-21527 Cornell U., Ithaca, N.Y. Electrical Engineering Research Lab.
STRETCHING PULSES WITH THE LINK STRUCTURE Technical Report No. 78
D. Mitchell Jan. 1964 54 p refs
(Contract DA-36-039-AMC-00034(E))
(EERL-1; AD-432967)

A theoretical and experimental study of a pulse-stretching network using the link structure is presented. The Bessel filter is found to be a good low-pass approximation to the ideal transmission line for use in the link structure. The realization of the Bessel filter is presented, and the impedance matching problems in the plate and grid lines are considered. A practical structure for a pulse-stretching network is formulated, and used in taking photographs of a 5-nanosec input pulse and the resulting output pulse, whose tracings are presented. Author

N64-21532 Microwave Associates, Inc., Burlington, Mass.
KA-BAND CRYSTAL PROTECTOR Third Quarterly Progress Report, 15 Sep.–15 Dec. 1963
Paul Basken and Rodney J. Whitney [1963] 55 p
(Contract DA-36-039-AMC-00157(E))
(AD-431647)

The design of the four-element crystal protector, the two-element pre TR, and efforts in the design of the solid-state varactor limiter were completed. In addition, the packaging of the pre-TR and crystal protector was completed. A series of life tests were conducted on the gas discharge devices, establishing the inadequacy of a single-fill gas TR tube, and the merits of a dual-fill combination. From these tests, the need of a gas reservoir was shown. Author

N64-21549 Kuthe Labs., Inc., Newark, N.J.
PRODUCTION ENGINEERING MEASURE FOR A PHASE II SUPER POWER HYDROGEN THYRATRON TUBE Sixth Quarterly Progress Report, 7 Jun. – 6 Sep. 1963
H. E. Krefft [1963] 50 p refs
(Contract DA-36-039-SC-85985)
(AD-431962)

Production engineering measures for a stacked, ceramic-metal construction, superpower hydrogen thyratron tube are discussed and include contruction of tubes, brazing and sealing of subassemblies, inspection of subassemblies, final assembly, exhausting of tubes, life test data, and test equipment. Tests performed showed the following results: (1) The present tube design satisfactorily conforms to specifications (within the limits of test capability). (2) Long tube life can be expected. (3) A reduction in cathode heater wattage without impairing other operating characteristics is desirable and feasible. P.V.E.

N64-21551 Microwave Associates, Inc., Burlington, Mass.
C- AND K_μ-BAND SEMICONDUCTOR TR DEVICES First Quarterly Progress Report, 1 Jul. – 30 Sep. 1963
Robert H. Brunton [1963] 51 p refs
(Contract DA-36-039-AMC-03187(E))
(AD-431966)

The basic diode limiter concept, limiter diode characteristics, and diode packaging considerations are discussed. The C-band TR concept has been determined through preliminary investigation. The diode package and a single-stage C-band limiter are described. In the K_μ-band work, several ridge waveguide test sections have been designed and measured. Data are given for PIN diodes in these test sections with a d.c. bias switching mode of operation. Other K_μ-band diode limiter circuits have been designed and are described. Author

N64-21559 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
HIGH-TEMPERATURE ANTENNA INVESTIGATION AND DEVELOPMENT Interim Engineering Report No. 4, Quarter Ending 31 Mar. 1964
Godfrey F. Buranich [1964] 25 p ref
(Contract AF 33(657)-11100)
(CAL-UB-1807-E-4; AD-434826)

This report summarizes the investigations for developing antennas suitable for prolonged operation at 2,000° F. The electrical suitability of low conductivity material for stub antennas was experimentally verified. Aluminum, stainless steel, and graphite ground planes were interchanged with no significant change in the antenna pattern gain. Stubs made of copper, tantalum, stainless steel, niobium, graphite, and "Boride Z"—a material made of zirconium diboride and 10% molybdenum disilicide—were interchanged, and these also produced no change in radiation pattern gain. Although platinum–rhodium alloys have adequate oxidation resistance and the additional characteristic of adequate strength at high temperatures, niobium and tantalum metals with protective coatings are 10 to 100 times less expensive and were therefore used in the model antennas. Investigation of borides, carbides, nitrides, and silicides showed that they are materials having suitable oxidation resistance at high temperatures, but are brittle and require the use of powder metallurgical techniques for fabrication of parts. Author

N64-21594 Tracerlab, Inc., Richmond, Calif. Western Div.
THE APPLICATION OF NUCLEAR TECHNIQUES TO THE MANUFACTURE OF HIGH-RELIABILITY PRINTED CIRCUIT BOARDS
I. J. Wright, J. B. Fishman, and C. E. Smedley Washington, AEC Div. of Tech. Inform., Dec. 1963 85 p refs
(Contract AT(04-3)-434)
(TID-20183) OTS: $2.00

Certain process solutions leave undesirable residues in the manufacture of printed circuit boards that are below the level of detectability by conventional analytical techniques. In this study, the use of radioactive tracers has been shown to be a valid technique for determination of the amounts of residual process contamination. Health and safety problems related to the use of such figures demonstrated to be minimal. By use of the radioisotope tracing technique, it has been shown that process contamination from resist paint and ferric chloride etch, employed in circuit board manufacture at or near normal manufacturing levels, causes an increase in solder joint defects. This degradation of solder joint reliability can be detected and controlled by production-line use of radiotracers. The corrosion potential of boards fluxed with radioisotope tagged flux can be determined by an integrated count rate of the entire board surface. Author

N64-21611 General Dynamics/Astronautics, San Diego, Calif.
THIN FILM PASSIVE CIRCUITS (REVISED)
J. E. Celto 16 Dec. 1963 61 p
(Contracts REA-111-9201; REA-111-9312; REA-111-9523)
(GD/A-63-1311; ERR-AN-401)

The processing steps and equipments used in the laboratory production of thin film passive circuits by the "Maskless Process" are described. Introductory comments related to the application of this miniaturization technique are included, and a description of the design steps that must precede the fabrication of a given circuit are included. The direction of future research is also briefly discussed. Author

N64-21619 Sylvania Electric Products, Inc., Waltham, Mass.
POWER SUPPLY PROTECTIVE CIRCUITRY Corrective Action Plan No. 1 P. S.
12 Feb. 1964 14 p
(AD-432059)

The protection circuits discussed do not represent a uniride system approach, and the reliability of these circuits is unacceptably low. (Specifically, power supplies *A*, *B*, *C*, and *D* include common and protective circuitry, whereas *E* and *H* do not.) A corrective plan of action is recommended as a solution to the high cost of common and protective circuitry in terms of reliability of the power supply types *A*, *B*, *C*, *D*, and *E*. The functions performed by the common and protective circuitry are discussed, and the studies conducted to obtain the recommended corrective plan of action are outlined. R.T.K.

N64-21624 Lincoln Lab., Mass. Inst. of Tech., Lexington
AN APPROXIMATE METHOD FOR THE CALCULATION OF SCALAR SCATTERING BY TWO-DIMENSIONAL BODIES Group Report 1964-1
A. D. Mac Gillivray and A. F. Smith 9 Jan. 1964 16 p refs
(Contract AF 19(628)-500)
(ESD-TDR-64-13; AD-431781)

A method for approximating the solution of two-dimensional scalar scattering problems was developed and tested. Results indicate that the technique involving the expansion of the field in terms of cylindrical wave functions gave good results when wavelength and body size are comparable. Author

N64-21650 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A DIRECT CURRENT TRANSFORMER
L. F. Sobeshchanskiy, M. V. Vlasov et al 9 Jan. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 129677, 30 Sep. 1959
(FTD-TT-62-117/1+2+4; AD-295449)

The direct-current (d.c.) transformer described belongs to the semiconductor family. It contains a master oscillator and a power transformer to which the load is applied. It is different from other existing d.c. transformers in that an auxiliary transformer with inductive feedback is used to excite the oscillator frequency, and the primary winding of this transformer is connected in parallel with the primary winding of the power transformer by two junction-type triodes with a common-control electrode. A.W.

N64-21665 Air Force Systems Comand, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF A SELF-ADJUSTING SYSTEM WHICH CONTROLS THE INTERMEDIATE QUALITY CRITERION
V. M. Kuntsevich and L. I. Chugunnaya 4 May 1964 15 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 2, 1963 p 3–12
(FTD-TT-64-41/1+2; AD-600482)

Investigation was made experimentally in the measurement of relative damping with both open and closed self-adjustment circuits in order to correct deficiencies in methods previously known and used. The devices used are shown schematically. The presence of sign-and-amplitude variable signals at the input of the system, during the execution of additional actions described in the report, and the proper selection of parameters do not disrupt the efficiency of the self-adjusting system. A.W.

N64-21666 Burroughs Corp., Paoli, Pa. Paoli Research Lab.
MAGNETIC LOGICAL TRANSDUCERS Final Report, 15 Mar. 1962 – 22 Aug. 1963
Oscar B. Stram and William F. Keenan Wright-Patterson AFB, Ohio, AFSC, Feb. 1964 46 p refs
(Contract AF 33(657)-8528)
(AL-TDR-64-22; AD-431256)

The central problem with respect to magnetic logical transducers is to find a means of expressing logical systems in a language more closely related to the physical nature of the magnetic logical transducer (as a threshold element) than the ordinary formulation in Boolean algebra. This report describes an approach to the problem using some of the techniques of lattice theory. A sufficient criterion for 3-monotonicity in 6-variable functions is also described in terms of lattice theory, and a theory of voting logic is advanced. Finally, the appendix gives recursive formulas for determining the input weights of magnetic logical transducers that will generate each of two particular complete, maximal chains of realizable functions for any number of variables. Author

N64-21667 Sperry Microwave Electronics Co., Clearwater, Fla.
CIRCULAR WAVEGUIDE DUPLEXERS AND CIRCULAR WAVEGUIDE MICROWAVE TRANSMISSION LINE
W. C. Heithaus Wright-Patterson AFB, Ohio, AFSC, Jan. 1964 115 p refs
(Contract AF 33(616)-6517)
(RTD-TDR-63-4141; AD-431733)

A survey is given of current technological progress in circular waveguide theory and technique. Results of prior research are correlated and presented along with a bibliography of sources consulted in the survey. This report also describes the development of duplexers, load-to-line isolators, adjustable attenuators, and controllable phase shifters for TE_{01} mode circular waveguide systems. Development problems are discussed, and the designs selected in overcoming these problems are described. These units were developed for each of two 6% frequency bands centered at 9.375 Gc (X band) and 35 Gc (K band). The use of the zero-db coupler and cruciform waveguide structures circumvented many of the problems associated with building ferrite devices for the TE_{01} circular electric mode without losing the advantage of high power capacity that the TE_{01} circular electric mode offers. The positions at which the microwave H-field is circularly polarized are more conveniently located in these structures than in ordinary circular guide propagating the TE_{01} mode. Seventeen demonstration models of eight different designs were delivered. In general, these components appear to have met the design goals of the program, and are believed to be the first units of their kind. Author

N64-21672 Nuclide Corp., State College, Pa.
VACUUM VIBRATOR ION SOURCE Report Period, 1 Mar. 1963–28 Feb. 1964
L. A. Cambey Wright-Patterson AFB, Ohio, AF Mater. Lab., Mar. 1964 18 p ref
(Contract AF 33(657)-11041)
(ML-TDR-64-75; AD-434675)

Three different vacuum vibrator sources have been designed and constructed. These sources were tested on a single focusing mass spectrometer. A preliminary evaluation of the characteristics of the source, including ion current magnitude, ion current stability, and ion energy spread, and their dependence on arc voltage and arc current has been carried out. Mass spectra obtained with the single focusing mass spectrometer are presented. Author

N64-21708 General Dynamics/Astronautics, San Diego, Calif.
ANALYSIS OF TWO NONLINEAR FLIGHT CONTROL SYSTEMS. PART I: LIAPOUNOV-LURJE APPROACH TO A SIMPLIFIED PITCH RATE AUTOPILOT. PART II: ANALYSIS OF A HIGH-GAIN ADAPTIVE PITCH RATE AUTOPILOT
T. R. Alex and C. R. Heermann Wright-Patterson AFB, Ohio, AF Flight Dynamics Lab., Apr. 1964 300 p refs
(Contract AF 33(616)-8243)
(ASD-TDR-62-369; AD-600771)

This report covers the analytical treatment of two nonlinear control configurations of interest to the flight-control designer. Stability borders and their properties were derived by the Liapounov–Lurje approach for third- and fifth-order versions of a simplified pitch rate autopilot. For each system version, pertinent Liapounov functions were set up and processed, then Lurje's stability equations separated and the latter processed as far as reasonable to yield sufficient stability conditions defined by discriminants in closed algebraic form. The treatment of each system version was paralleled by analyses based on the method of harmonic balance. Simple mathematical expressions for estimating the oscillation or limit cycle parameters of a high gain adaptive pitch rate autopilot involving an 8th order system with 2 nonlinearities were derived. For the closer study of the system response to gain perturbations, an equivalent third-order model operating at the stability border was derived and investigated for the possibility of parametric excitations. Ultimately, by introducing a sampling concept, a method for approximate computation of the system response to gain changes was derived. Author

N64-21723 RAND Corp., Santa Monica, Calif.
INVARIANT IMBEDDING AND THE ANALYSIS OF PROCESSES
Robert Kalaba Aug. 1963 28 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3806-PR; AD-414523)

Many of the processes considered in modern physics and control theory lead, from the mathematical viewpoint, to nonlinear two-point boundary-value problems. These problems are difficult to treat computationally and analytically. A goal of the theory of invariant imbedding is to provide a systematic technique for converting these boundary-value problems into initial-value problems through the use of appropriate variables and the employment of functional equation techniques. A particle multiplication process is considered for illustrative purposes. The classical equations and the invariant imbedding equations are derived, and various interconnections are discussed. The paper is intended to be self-contained. Author

N64-21781 General Electric Co., Philadelphia, Pa. Missile and Space Div.
RESISTANCE VARIATION OF EXPLODING WIRES
R. C. Good, Jr. Mar. 1964 24 p refs Presented at the 3d Conf. on Exploding Wire Phenomenon, Boston, 10 Mar. 1964
(R64SD23; AD-434709)

When fine wires are exploded by discharging a capacitor, to date the resistance has been calculated either by integrating twice in succession the record of the rate of change of the current, or by the current–voltage method. A different approach is proposed in which the circuit equation is differentiated with respect to time and then solved by a method similar to the WKB method. The method is discussed, original data provided, and values of calculated resistances obtained by the double integration method used to indicate the validity of the solution. Author

N64-21812 Illinois U., Urbana Electrical Engineering Research Lab.
RESEARCH STUDIES ON PROBLEMS RELATED TO ANTENNAS
James Rippin Mar. 1964 62 p refs
(Contract AF 33(657)-10474)
(QPR-5; AD-439528)

The problems and studies reported include: radiation from periodic structures, log-periodic cavity-backed slot antennas, log-periodic magnetic-current antenna, log-spiral antennas, antennas for airborne direction finding, integrated antenna amplifier, wave propagation along helical conductors, periodic structures for wideband applications, log-periodic antennas, and radiating lens illuminated from a Goubau beam-waveguide. A.W.

N64-21827 Joint Publications Research Service, Washington, D.C.
PRINCIPLES FOR BUILDING COMBINATION AUTOMATIC CONTROL SYSTEMS WITH VARIABLE STRUCTURE
B. N. Petrov and S. V. Yemel'yanov 26 May 1964 9 p ref
Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 153, no. 2, 1963 p 1020–1023
(JPRS-24767; OTS-64-31334) OTS: $0.50

Combined tracking systems, in a number of cases, are employed with the aim of improving the statistical and dynamic accuracy of the reproduction of the controlling influence. The transitive processes in such a system may be described by a linear nonhomogeneous differential equation (1) $M(p)x = N(p)g(t)$, where $M(p)$, $N(p)$ are the operator polynomials relative to p; $p \equiv d/dt$; x is the error signal; and $g(t)$ is the controlling influence appearing as a continuous function of time. The independence of the error signal x from the controlling influence $g(t)$ is commonly determined by the assumption that (2) $N(p) = 0$. In this case the forced component, $x_{forced}(t)$ of the integral of the differential solution of (1) is identically equal to zero. Generally, the following will be required for the solution of (2): (a) differentiation of the controlling influence and (b) invariability of the parameters of the open and closed cycles of the combined tracking system. This report proposes a solution of this problem by not requiring the fulfillment of the conditions of equation (2), thereby weakening the influence of the restrictions (a) and (b). I.v.L.

N64-21829 Northern Electric Co., Ltd., Ottawa (Canada) Research and Development Labs.
DEVELOPMENT OF MICROMINIATURE SOLID STATE CIRCUITS Final Report, Mar. 1, 1963–May 1, 1964
J. Y. Perron et al [1964] 22 p refs
(Contract DRB-300007)

Investigation of processes and techniques for manufacture of microminiature semiconductor circuits was carried out by attempting to develop: (1) a reliable microminiature amplifying and integrated circuit for a radiation survey instrument; (2) a constant current source; and (3) a reliable microminiature switching element, type NOR, to operate at one megacycle per second repetition rate. The fabrication of tantalum thin-film resistors and capacitors for the rate survey meter has shown that improvement in yields can be obtained by modifications in the grain structure of the deposited film. In working on the constant current source, mechanical limitations have led to a diffused structure that needs further investigation. The integration of a NOR gate has resulted in a better understanding of the technique and has also emphasized some trouble areas, such as isolation diffusion and collector saturation resistance. P.V.E.

N64-21833 Michigan U., Ann Arbor. Electron Physics Lab.
RESEARCH AND DEVELOPMENT ON HIGH-POWER CRESTATRONS FOR THE 100–300 MC FREQUENCY RANGE Report Period, Oct. 1, 1963–Jan. 1, 1964
G. T. Konrad and C. K. Rhee Jan. 1964 33 p
(Contract NObsr-81403)
(QPR-14; AD-431638)

A series of trajectory plots is shown that led to a reasonably good electrical design for the $P_\mu = 20$ gun. The work done on the electrostatically focused tube using a $P_\mu = 4.46$ gun indicates that much better focusing can be obtained with the improved gun. At reduced voltages the beam transmission is only fair, but the percentage of transmission improves as the design voltage is approached. In order to center the operating band of the 100-w Crestatrons more nearly within the desired frequency range and in order to overcome the RF losses observed in the couplers, a revision is made in the tube design. The new dimensions and electrical parameters are shown. Author

N64-21841 Army Signal Research and Development Agency and Lab., Fort Monmouth, N.J.
TELEPHONE–TELEGRAPH CARRIER TERMINAL TA-5006A/U Test Report
27 Jan. 1964 279 p
(AD-431668)

Engineering tests of the telephone–telegraph carrier TA-5006A/U are evaluated, and its compatibility with other standardized military equipment is determined. The TA-5006A/U is a frequency-division multiplexing terminal with five communication channels—four carrier-derived and one voice-frequency order wire. It has integral facilities for signaling, lineup, testing, and supplying of operating power. It has a transmission bandwidth of 300 to 20,000 cps and can be used for two-way transmission over loaded quad cable, loaded spiral-four cable, open wire lines, and radio links. In addition to operation and service-condition tests, the following were performed: equipment compatibility tests, component and maintenance review, and human-factors engineering review. Data are presented for each category. E.K.R.

N64-21842 Magnavox Co., Fort Wayne, Ind. Government and Industrial Div.
QUARTZ CRYSTAL OSCILLATOR CIRCUITS STUDY Third Report, 1 Mar.–30 Sep. 1963
D. Firth 10 Mar. 1964 148 p
(Contract DA-36-039-AMC-00043(E))
(TP63-994; AD-433816)

This report presents a design procedure for two types of Pierce transistor oscillators in the 0.8- to 20-mc range. The first of these is a derivative of the "basic" Pierce circuit, which, at the cost of a slight increase in circuit complexity, is capable of an increased output power relative to that of the basic circuit. This type of oscillator is considered useful for transmitter–driver applications. The second type is the basic Pierce circuit that will be useful in low power level applications, such as the local oscillator in small signal mixing operations. The report contains background data concerning the behavior of common emitter transistor amplifiers in this frequency range and continues the analysis of the crystal π feedback network. Design calculations for each type of oscillator are presented, together with the design evaluation data. Author

N64-21847 Westinghouse Electric Corp., Washington, D.C.
500 WATT SILICON POWER TRANSISTOR
[1964] 35 p refs
(Contract NObsr-91001)
(QR-2; AD-431756)

Two testing methods and equipment for each were completed and put into operation. These testers, in conjunction with the present power test method, cover both the transient and steady-state operation of a device. They now allow an adequate measure of the device capability. Device design calculations were made using both manual and computer methods. Initial checks on junction characteristics were made. Preliminary design of the encapsulation was made. The dimensions, however, are not scheduled to be finalized until the device design is completed. Author

N64-21849 Sperry Gyroscope Co., Great Neck, N.Y. Electronic Tube Div.
SUPERPOWER MICROWAVE WINDOWS Quarterly Progress Report No. 3, 2 Jul.–1 Oct. 1963
D. B. Churchill and A. S. Ferello Oct. 1963 46 p refs
(Contract DA-36-039-AMC-02161(E))
(NA-8240-8345-3; AD-431260)

Mechanical assembly problems necessitated design changes in windowtron D-1. The evacuated waveguide section will be lengthened to 3.3 in. to facilitate the vacuum-tight brazing operation. Calculations indicate that this change will reduce the bandwidth by about 60%, but the transmission function will remain maximally flat. Demountable models of the scaled window assemblies were completed. The L-band prototype model has a nearly flat transmission function with a 1.1 VSWR bandwidth of more than 40%. The scaled, C-band model will be fitted with a waveguide transformer section before its bandwidth and other properties are measured. Windowtron A-4 was tested up to a peak power level of 8 megw without damage to the central sapphire-disc window. At this power level seal-edge arcing caused the output window to implode. Temperature data taken before the implosion showed that the test window ran substantially cooler than either the sintered-alumina or lucalox discs tested earlier in the same windowtron structure. Windowtron B-2 was tested to destruction by high power operation. The first disc of the output window cracked at power levels of 31.5-megw peak and 12.6-kw average. Cracking was attributed to mechanical strains induced by the heat of multipactor discharge at the vacuum-side surface of the disc. A detailed analysis of the circular electric-mode window test cavity showed that its gain in the absence of electronic loading was 264. The first series of high power tests made with the cavity showed monotonically increasing multipactor loading as a function of power level, but yielded inconclusive results regarding the effectiveness of a titanium film. Detuning of the cavity resonance by the titanium film obscured the reduction of multipactor discharge. Author

N64-21994 CBS Labs., Stamford, Conn.
QRC-214(T) WIDE BAND RECORDER AND SUPPORTING EQUIPMENT Informal Technical Monthly Progress Report No. 10, 16 Jan.–15 Feb. 1964
Frank A. Comerci 10 Mar. 1964 7 p
(Contract AF 33(657)-10468)
(CLD-1596; AD-432487)

The progress made in the ground and airborne systems is presented. The processing electronics for both the ground and airborne systems were completed and adjusted. Measurements of the systems, operating on an overall electrical basis, showed response from dc to 10 mc and the ability to process square waves and pulses of 0.1-microsecond duration. The airborne system was readied for environmental tests. Preliminary reference measurements were obtained, and recordings were prepared for evaluation purposes. The reproducing amplifiers of the ground system were wired to the reproducing head and processing electronics and were found to be oscillating due to the inductive-source impedance of the heads and to the added loads on output circuits. The condition has been corrected, and equalization of the recording–reproducing systems is now in process N.E.A.

N64-22084 SFD Labs., Inc., Union, N.J.
LONG LIFE K-BAND COAXIAL MAGNETRON Quarterly Progress Report No. 9, 1 Jul.–1 Oct. 1963
P. du Fosse and M. Liscio Oct. 1963 32 p
(Contract DA-36-039-SC-87347)
(SFD-16-QPR-9; AD-434273)

Two new 24 Gc ICEM coaxial magnetrons were constructed and evaluated, and three tubes were rebuilt. One rebuilt tube was a life test tube that suffered a heater weld failure. To date, a total of 8,543 hours of radiate time have been accrued on four tubes. Shock and vibration test results are reported, as well as those of the accelerated heater cycling program. Author

N64-22099 Sperry Microwave Electronics Co., Clearwater, Fla.
HIGH POWER FAST FERRITE SWITCHES Interim Report No. 2, 27 Sep.–27 Dec. 1963
B. J. Duncan et al Feb. 1964 36 p refs
(Contract NObsr-89428)
(SJ-222-0047-2; AD-434541)

The SPST switching elements were evaluated at medium power levels and found to be unsatisfactory because of increased insertion loss. Investigations were then conducted to derive the optimum ferrimagnetic material and waveguide geometry for the best SPST switching operation and for minimum high power effects. A 10-percent switching bandwidth has been obtained with a structure that shows no onset of subsidiary resonance effects below 150 kw, and a materials trend has been established by which it is thought that operation at 1 mw will be achieved. Initial investigations have been made at S-band frequencies. Very low insertion loss has been obtained at low power, but 10-percent switching bandwidth has not yet been achieved. Author

N64-22151 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SYNTHESIS OF THE CHARACTERISTICS OF LINEAR ANTENNA SYSTEMS
P. Szulkin 14 Feb. 1963 36 p refs Transl. into ENGLISH from Prace Przemyslowy Inst. Telekomunikacji (Warsaw), v. 10, no. 30, 1960 p 15–30
(FTD-TT-62-1141/1+2+3+4; AD-297569)

A systemization of existing methods for synthesizing the radiation patterns of linear antenna arrays is presented. An attempt is made to generalize and modify these methods. The method of direct synthesis of a pattern in which the space factor has the form of a Fourier series is examined. This method is used to determine the optimum cophasal current distribution of the antenna system and the axial-radiation system. A linear array design method that provides for maximum beam directivity is presented. N.E.A.

N64-22155 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHODS OF CONVERTING VOLTAGES INTO BINARY CODES
M. G. Reynberg 14 Apr. 1964 20 p refs Transl. into ENGLISH from Tsifrovaya Tekhn. i Vychislitel'ney Ustroystva (USSR), No. 2, 1962 p 153–163
(FTD-TT-63-1143/1+2+4; AD-600587)

This paper describes a method of analog-to-digital conversion that combines the method that uses an intermediate conversion into a time interval with the method of sequential weighing with compensation circuits. In the compound converter, the higher digits of the code are formed by the proposed method and the lower digits by the usual time-conversion method; this results in a saving of coding time with only a slight increase in equipment. The basic instrument error of the compound converter results from the coding-method characteristics, and does not exceed the corresponding error in time converters. D.S.G.

N64-22181 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON A METHOD OF SUCCESSIVE APPROXIMATIONS FOR THE SOLUTION OF OPTIMAL CONTROL PROBLEMS
I. A. Krylov and F. L. Chernous'ko 1 Aug. 1963 16 p refs Transl. into ENGLISH from Zh. Vychislitel'noy Mat. i Mat. Fiz. (Moscow), v. 2, no. 6, 1962 p 1132–1139
(FTD-TT-63-701/1+2; AD-417581)

The solution of boundary value problems for complex nonlinear systems often presents significant computational difficulties, as well as a large expenditure of machine time. Therefore, a method of solving optimal control problems, which circumvents these difficulties, is presented. A method of successive approximations that is based on the maximal principle is proposed for the determination of optimal control. The method is illustrated by solving a variational problem by the proposed method and by a numerical solution. R.T.K.

N64-22199 Electronic Communications, Inc., Timonium, Md. Research Div.
DIODE, MILLIMETER WAVE TYPE MIXER (3.2 mm) Second Quarterly Progress Report, 1 Sep.–30 Nov. 1963
R. J. Bauer and J. W. Dozier 30 Dec. 1963 40 p refs
(Contract DA-36-039-AMC-02347(E))
(Rept.-2; AD-433797)

A brief description is presented of the problems encountered with RF impedance measurement equipment and klystrons. Results are described of the conversion loss, crystal noise ratio, and RF impedance of gallium arsenide–phosphor bronze diodes in an electroformed waveguide mixer mount. A method is presented for observing the RF rectification characteristic of a diode while it is being formed. Data on variable waveguide shorts is compared. Eutectic bonding and solder mounting of germanium, gallium arsenide, and silicon to metal support posts are described. Electrolytic pointing results of zinc, aluminum, phosphor bronze, and tungsten whiskers are also described. Crystal material characteristics are listed for tunnel diodes. Author

N64-22210 Mallory (P.R.) and Co., Inc., Indianapolis, Ind.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SOLID ELECTROLYTE TANTALUM CAPACITORS
A. W. H. Smith [1963] 36 p
(Contract DA-36-039-AMC-03623(E))
(QR-2; AD-433805)

Discussed is work performed on production engineering measures needed to improve production techniques for the manufacture of 33 mfd–35 volt solid electrolyte tantalum capacitors to attain a maximum failure rate of 0.001 percent per 1,000 hours with a 60-percent confidence level. A procedure for electrical evaluation of tantalum wire has been outlined. The ability of the procedure to distinguish between types of wire and differences in processing has been demonstrated. An indication that chemical purity of the anode affected the reformation breakdown voltage more significantly than did the wet cell was obtained from the results of experiments with anodes contaminated with iron. Conditions for dehydration prior to final sealing of the capacitors have been worked out and incorporated into specifications. Failure analyses of rejects from the first pilot run indicated that assembly procedures could be related to yield and performance. P.V.E.

N64-22211 Raytheon Co., Newton, Mass. Industrial Components Div.
RESEARCH AND DEVELOPMENT ON TRAVELLING IMAGE STORAGE TUBE
Gordon R. Spencer Wright-Patterson AFB, Ohio, Res. and Technol. Div., Mar. 1964 43 p
(Contract AF 33(616)-11674)
(IER-1; AD-433860)

The objective of this program is to determine the feasibility of a display device that permits continuous, real-time observation of data acquired from line-span systems. The feasibility was investigated of fabricating a cathode-ray device with the following features: (1) tenebrescent (dark-trace) writing and storage; (2) viewing by ambient, reflected light; (3) a continuously moving, variable speed, endless-belt target within the tube; and (4) positive, direct mechanical-motion coupling through the vacuum envelope. R.T.K.

N64-22213 General Electric Co., Daytona Beach, Fla. Apollo Support Dept.
INTERFERENCE REDUCTION TECHNIQUES FOR NONLINEAR DEVICES Quarterly Progress Report No. 2, 15 Sep.–15 Dec. 1963
R. P. Bouchard, E. R. Klein, and J. C. Otto [1963] 63 p
(Contract DA-36-039-AMC-02278(E))
(Rept.-64-SIMAR-27/2; AD-433682)

Analysis of the parametric modulator indicated that the spectrum could be improved by predistorting the carrier signal. Therefore, a predistortion circuit was breadboarded and evaluated. A significant reduction in the amplitude of the terms of the form of $nf_c \pm f_s$ for $n = 1$ resulted. An increase in the amplitude of nf_c terms also occurred. Results from the breadboard model verified the analytical results. Optimization of the parametric modulator showed that a linear capacitance configuration modulator gave a better spectrum than did the conventional varicap modulator. Author

N64-22243 Applied Psychological Services, Wayne, Pa.
DESIGN FOR A TACTUAL STIMULATOR CAPABLE OF DELIVERING MICROGRAM FORCES
Arthur I. Siegel, Joseph J. Bulinkis, Ronald W. Hatton, and Phillip J. Sentner 17 Apr. 1964 56 p

The theoretical basis for a tactual stimulator capable of delivering microgram forces is presented. The mechanical design and the electrical design for an apparatus that will allow precise microgram stimulus delivery for measured time intervals, are given. The apparatus, which possesses a sensitivity not heretofore attainable, would be useful for determining stimulus limens and two-point thresholds. Author

N64-22269 Varian Associates, Palo Alto, Calif.
HIGH POWER R-F WINDOW STUDY PROGRAM Quarterly Technical Note 2, 1 Oct.–31 Dec. 1962
Floyd Johnson Jan. 1963 38 p refs
(Contract AF 30(602)-2844)
(VARIAN-304-2Q; RADC-TDR-63-32; AD-299552)

Three fused quartz thin disc window assemblies were fabricated and tested in the ring resonator. Extreme localized dielectric heating was responsible for failure of two of the windows by melting. Failures occurred at power levels of 70 kw CW or less in a nitrogen atmosphere. Fabrication of a single disc zero degree cut sapphire window was completed and high power tests performed. This window was operated up to 235 kw of power without failure or damage to the dielectric. Steady state power dissipation of this window was less than any window tested on this program to date. A windowtron was constructed using this device for tests with other window designs in vacuum. The crystal structure of other sapphire discs was also closely examined for spurious effects on window impedance matching. Two vacuum-tight double disc aluminum oxide window assemblies were completed, with one of them failing in high power test at 180 kw CW at 7,750 mc. This window had a mode free bandwidth of 33% and was continuously cooled by recirculated FC75, an inert fluorocarbon liquid. The remaining window failed because of excessive cooling fluid pressures. Three successfully brazed vacuum-tight beryllium oxide half-wavelength block windows were completed, and high power tests showed that power transmission was as good as previously reported for this type of window. A maximum power of 252 kw was transmitted with losses amounting to 0.37% of the total power. Author

N64-22278 Motorola Inc., Phoenix, Ariz. Semiconductor Products Div.
DETAILED STUDY OF DELETERIOUS EFFECTS ON SILICON TRANSISTORS
Griffiss AFB, N.Y., RADC, Apr. 1964 47 p
(Contract AF-30(602)-3244)
(RADC-TDR-64-111; AD-600875)

Deleterious surface phenomena, such as junction leakage current, junction breakdown voltage, current gain degradation, etc., observed on n-p-n and p-n-p silicon transistors, insulated-gate unipolar-field-effects transistors, and surface-controlled bipolar transistors, are described in detail. The models fitting the surface phenomena observed are presented. Also, brief discussions of application of surface phenomena are included. Author

N64-22308 International Business Machines Corp., Owego, N.Y. Federal Systems Div.
EXPERIMENTAL PROGRAM TO DETERMINE THE FEASIBILITY OF USING ANALYTICAL TECHNIQUES IN ANALYZING RADIATION EFFECTS TO FLIGHT CONTROL SYSTEMS
30 Sep. 1963 191 p
(Contract AF 33(657)-8104)
(IBM-63-521-21; RTD-TDR-63-4147; AD-430820)

The effects of pulsed and steady-state nuclear radiation on an advanced flight control system have been investigated. This report describes the results of experimental studies of selected circuits from this flight control system. The objectives of this work were to experimentally measure circuit and component changes, to modify these circuits to improve their radiation tolerance, and to compare the experimental results with theoretical analyses. To achieve these goals, five circuits were studied in two series of radiation tests at the Sandia Pulsed Reactor facility. Experimental data were shown to be consistent with theoretical interpretation based on analysis of circuit operation and effects in the individual components. Author

N64-22362 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANALYSIS AND SYNTHESIS OF AMPLIFIER CIRCUITS
L. Ya. Nagornyy 10 Feb. 1964 316 p refs Transl. into ENGLISH from "Analiz i Raschet Usilitel'nykh Skhem" Kiev, Gos. Izd. Techn. Lit., 1963 p 1–244
(FTD-TT-63-1011/1+2+4; AD-432069)

This book presents the development of a general method of analysis and synthesis of electron-tube and transistor circuits operating in the linear range. This method is based on the generalized methods of node potentials and loop currents and makes it relatively easy to determine expressions for the basic parameters of the amplifier, to determine their relative change with variation of several parameters of the circuit elements, and to investigate the final expression of the basic characteristics of the amplifier depending on variation of any parameter of the elements of the circuit for the case where all of them are complex numbers, etc. The basic calculating formulas expressed in terms of the determinant of the circuit matrix and its cofactor are presented in tables. Author

N64-22411 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A METHOD FOR REPRESENTING CODE VALUES OF OPTIMAL NONUNIFORM CODES ON THE MASKS OF CATHODE-RAY DECODING TUBES
D. A. Novik 23 Jan. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 136099, 20 Jun. 1960
(FTD-TT-61-461/1+2+4; AD-285824)

The essence of the proposed method is the combining of numbers corresponding to the duration of a code combination and its order number. The number obtained from the combination is divided into approximately equal parts from which horizontal and vertical coordinates are formed for recording on the mask of the tube. N.E.A.

N64-22414 Istituto Superiore Di Sanita, Rome (Italy) Laboratori Di Fisica
ELECTRONIC SERVICE-CIRCUIT DIAGRAMS AND CHARACTERISTICS OF STANDARD ELECTRONIC EQUIPMENTS E 121 TO E 130 [CATALOGO DELLE APPARECCHIATURE ELETTRONICHE STANDARDIZZATE DA E 121 A E 130]
20 Mar. 1963 41 p In ITALIAN; ENGLISH summary
(ISS-63/25)

This publication is a catalog of circuit diagrams and characteristics of electronic equipments built by the electronic service of the Laboratory of Physics. Its main purpose is to give to the experimenter a short account of equipments available off the shelf. The catalog will be printed in many issues each containing the data of 10 equipments; an index of all issues will be printed periodically. Specific new technical and scientific items are omitted; bibliographic items are added for some new circuits. Author

N64-22494 Illinois U., Urbana Gaseous Electronics Lab.
INVESTIGATION OF MICROWAVE DUPLEXER SWITCHING MECHANISMS
J. A. Dayton, Jr., J. T. Verdeyen, and L. A. Weaver 15 Jul. 1963 39 p refs
(Contract DA-36-039-AMC-00066(E))
(Rept.-2; AD-418142)

Sound waves were established in various gases by intense local RF breakdown. The propagation velocity of these waves

is measured by electrical and electromechanical pressure transducers, and these velocity measurements were used to determine the temperature of the neutral gas in a d.c. discharge and to study the presence of ozone in RF discharges in air and oxygen. Experimental investigation of the nonlinear interaction of electromagnetic waves with shock waves was initiated. Experiments performed to date indicate that shock velocities to at least Mach 15 can be produced in the experimental apparatus. Author

N64-22495 Westinghouse Electric Corp., Baltimore, Md. Electronic Tube Div.
PHOTOELECTRIC INFORMATION STORAGE Interim Engineering Report No. 1, 1 Jun.–31 Aug. 1962
W. G. Reininger and A. S. Jensen [1962] 20 p
(Contract AF 33(657)-8715)
(A-51035AR1D; Rept.-437; AD-291551)

Several nickel and copper target tapes were procured and processed for testing and evaluation in the UV demountable system. Storage parameters were measured in the scrolled and unscrolled positions. Copper tapes and targets showed a surface granularity peculiar to the material. An electronic shutter was designed, built, and operated satisfactorily on the demountable system. A simple resistive network was designed that permitted shutter operation without any additional voltage supplied. Reading transfer characteristics were measured, and families of curves were plotted. These results were verified with gray scale storage experiments. Resolution measurements were quantitatively made, using the Westinghouse bar pattern in combination with line selector and A-scope. New paint materials were evaluated for spiral accelerator making. Smoothness of the interior surface of the glass envelope is important in obtaining uninterrupted spirals. Several nickel and copper tapes were processed for storage parameter determinations in the UV demountable header. Author

N64-22510 ITT Federal Labs., Nutley, N. J.
RESEARCH AND INVESTIGATION ON THE TRANSMISSION LINE ANALOG OF SOME FUNCTIONS OF THE COCHLEA
L. M. Vallese May 1964 81 p refs
(Contract AF 33(657)-8873)
(AL-TDR-64-108; AD-600742)

The feasibility of design of a tune learning machine, capable of demonstrating learning of given time sequences of tones by an automaton, is investigated. A complete unit possessing sources of internally generated tones, sensors of external tones, controls of the internally generated tones, memory, etc., is described. A Fourier analyzer consisting of an advanced version of a previously designed cochlea analog model is also presented. Author

N64-22512 National Cash Register Co., Dayton, Ohio Military Development and Marketing Dept.
HIGH RESOLUTION RAPIDLY PROGRAMMABLE MASKING FOR FUNCTIONAL ELECTRONIC BLOCKS Interim Engineering Report
Mark Sobottke et al 10 May 1964 82 p
(Contract AF 33(615)-1158)
(NCR-28-21; AD-600714)

A study phase is in progress and includes the areas of maskmaking requirements, positioning systems, and optical techniques. Studies to date have defined masking requirements, maskmaker specifications, and programmable maskmaker systems. Currently, a limited engineering model of a programmable maskmaker is being designed and fabricated. Author

N64-22523 Aberdeen Proving Ground, Md. Ballistic Research Labs.
HIGH IMPEDANCE CATHODE FOLLOWER FOR PIEZOELECTRIC GAGE RECORDING IN AIR BLAST RESEARCH
Bernard Soroka and Jacob Wenig Apr. 1963 37 p
(BRL-1474; AD-410170)

The design of four types of single tube cathode followers is described and selections made of the ones best suited for use with an 8-channel unit employed for airblast research. Exact formulae as well as simplified good approximations for gain, input impedance, and output impedance are derived. This report may serve as a reference source for cathode follower design and circuit analysis. Author

N64-22533 Sperry Rand Corp. Philadelphia, Pa. UNIVAC Div.
RESEARCH ON LOW-POWER MAGNETIC-FILM MEMORIES Interim Engineering Report No. 1, 14 May 1963–14 Aug. 1963
T. J. Matcovich [1963] 31 p
(Contract AF 33(657)-11199)
(AD-419342)

The objective is to demonstrate the feasibility of fabricating microminiaturized evaporated circuitry for use with the low-power magnetic-film memory elements. The layout of a 64-word, 24-bit-per-word memory system, complete with address registers and timing circuits, was completed. This layout is used to insure the compatibility of individual circuit designs with the system. A word driver, two bit drivers, and a sense amplifier were designed, and breadboard models were constructed and tested. Word drivers were evaporated, and a driver was used to operate bits on a 4-by-4 memory array. Bit drivers were evaporated but not tested. The physical layout of the sense amplifier is being designed. Techniques for the preparation of evaporated resistors were improved to the extent that resistance tolerance is now ±15%. Large memory arrays of 64 words, 24 bits per word, were also successfully evaporated. Disturb tests were performed on individual bits. The disturb/current margin on good films is 100%, even after 10^4 disturb pulses are applied. Author

N64-22534 Michigan U., Ann Arbor Electron Physics Lab.
RESEARCH AND DEVELOPMENT ON HIGH-POWER CRESTATRONS FOR THE 100–300 MC FREQUENCY RANGE Quarterly Progress Report No. 15, 1 Jan. – 1 Apr. 1964
G. T. Konrad and C. K. Rhee Apr. 1964 29 p
(Contract NObsr-81403)
(Rept.-03783-16-P; AD-600595)

A series of trajectory plots for a reduced diameter $P_\mu = 20$ gun is shown. A reasonably well-behaved beam throughout the gun region is obtained. The electrostatically focused tube using one of the improved $P_\mu = 4.46$ guns is seen to yield only fair transmission to the collector at reduced voltages. Some low-level oscillations appear to limit the transmission. The revised design of the 100-w Crestatrons resulted in a tube with sufficient gain and power output. Only very minor modifications in the design were necessary for the final tubes. Author

N64-22685 Rome U. (Italy) Ist. Di Elettronica
PROPAGATION OF ELECTROMAGNETIC WAVES IN RECTANGULAR GUIDES LOADED WITH MAGNETIZED FERRITE Final Technical Report
Giorgio Barzilai and Giorgio Gerosa 11 Mar. 1964 14 p refs
(Contract AF 61(052)-101)
(AFCRL-64-354; AD-601134)

Further investigations were carried out to analyze the behavior of the propagation constant versus the frequency for

the zero order modes of a rectangular guide partially filled with a slab of transversely magnetized lossless ferrite situated against one side wall. For the same structure the zero-order modal spectrum for the case of lossy ferrite was investigated. Some experiments aiming to measure the phase constant for a unidirectional mode of the same structure are recorded. Author

N64-22692 Sperry Rand Corp., Philadelphia, Pa. UNIVAC Div.
SYNTHESIS OF LOGIC FUNCTIONS ON AN ARRAY OF INTEGRATED CIRCUITS Scientific Report No. 1
L. M. Spandorfer and J. V. Murphy 31 Oct. 1963 56 p refs
(Contract AF 19(628)2907)
(AFCRL-63-528; AD-439664)

This paper considers the problem of synthesizing large-scale logic on an array of microcircuits with particular attention to topological aspects arising from the interconnection and crossover problems. The results are applicable to semiconductor, thin-film, and hybrid microcircuits. A theorem is given, believed to be new, showing that all switching functions can be synthesized by collecting logic elements and interconnecting paths in a way that no logic paths intersect or cross over one another. Specific techniques for synthesizing functions in planar, i.e., crossoverless, form are explored. Algorithms are given for synthesizing any logic function on two layers of interconnections. The assumptions are that any logic element can be connected only to its neighbors in the array and that each interconnecting line, or path, can be assigned to either layer 1 or layer 2 by a very simple rule. A study of how the algorithms can be modified to handle faulty logic elements is presented, thus establishing a rerouting capability. Author

N64-22694 Lockheed Missiles and Space Co., Sunnyvale, Calif.
ELECTRONIC COUNTERMEASURES AND COUNTER-COUNTERMEASURES: AN ANNOTATED BIBLIOGRAPHY Supplement No. 1
George R. Evans, comp. Jul. 1963 186 p refs
(Contract NOw-63-0050-C)
(SB-63-64; Rept.-8-40-63-12; AD-440887)

Specific areas of interest are jamming, antijamming, deception, interception, interference, and decoys. Although the search dealt primarily with active ECM and ECCM in radar systems and radar systems integrated with radio-communications systems, some significant references to passive countermeasures techniques and systems are included. Author

N64-22712 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
MICROWAVE TUNNEL DIODE DEVICES
Robert D. Hall 20 Mar. 1964 61 p ref
(Contract DA-36-039-AMC-00088(E))
(EDL-M609; AD-601577)

Properties, advantages, and defects of tunnel diodes are reviewed, and design principles that will allow their use in many applications are pointed out. Equivalent circuits of diodes are discussed, along with designs for microwave circuits in which they can be embedded. Author

10 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations. *For related information see*: 06 Auxiliary Systems.

N64-21550 Mitre Corp., Bedford, Mass.
AN AIRBORNE COMMUNICATION SIMULATION (COMSIMP)
Irwin Shear Feb. 1964 116 p
(Contract AF 19(628)-2390)
(ESD-TDR-63-493; TM-3844; AD-431200)

This document describes a simulation of communication capability between two aircraft or between one aircraft and a ground station. The program considers aircraft geometry, antenna radiation patterns, and transmitter power. Author

N64-21652 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MN-7 MINIATURE NONLINEAR ELECTRONIC SIMULATOR
11 Oct. 1962 8 p Transl. into ENGLISH from Mashinostroyeniya (Moscow), 1960 p 1–5
(FTD-TT-62-1236; AD-288529)

The MN-7 is an analog mathematical machine designed for investigating the dynamics of systems and objects of automatic control, the motion of which is recorded by ordinary differential equations having a small number of nonlinear dependencies. A solver unit, an I-5 electronic-beam indicator, and an ESV-6 power unit make up the MN-7. Its overall dimensions are 500 × 240 × 360 mm; its weight is 22.5 kg. A.W.

N64-21695 Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (W. Germany)
AERODYNAMIC MEASUREMENT TECHNIQUE Report on the Third Meeting of Subcommittee [AERODYNAMISCHE MESSTECHNIK Bericht über die 3.Sitzung des Unterausschusses]
Alfred Heyser (DVL) [1963] 153 p refs In GERMAN
(WGLR-8/1963) WGLR: 31 DM

The following papers are presented: (1) "Tension Strip-Chart Balances"; (2) "Tension Strip-Chart Balances for High-Speed Wind Tunnels"; (3) "Wind Tunnel Balances with Strip-Charts"; (4) "Multicomponent-Mounted Balances for Measurements on Rolling Models"; (5) "Air-Resistance Measurements with Doppler Radar"; (6) "Attempts at Power Measurement in a Supersonic Shock Tube"; (7) "Multicomponent Thrust-Measuring Balances for Engines and Test Models"; (8) "Improvements of the Mechanical Six-Component Balances at the Darmstadt Institute of Flight Mechanics"; (9) "A Pneumatic Thrust-Measuring Device"; and (10) "Measurements of Aerodynamic Values on Models with Exhaust." I.v.L.

N64-21804 Pennsylvania Research Associates, Inc., Philadelphia
INVESTIGATION OF DIGITAL TECHNIQUES FOR RADAR LAND MASS SIMULATION Final Report No. 3
Alfred Weinrauch Port Washington, N.Y., Naval Training Device Center, 13 Mar. 1964 315 p refs
(Contract N61339-1025)
(NAVTRADEVCEN-1025-3; AD-600347)

This report summarizes the history of radar land-mass simulation and the motivation for investigating digital techniques. A hybrid radar simulator system concept and overall design are discussed. The general relationships between the simulation system and the missions and features of interest are considered, with some analysis of relevant design tradeoffs that could be used. Extensive consideration is also given to the phenomena perculiar to radar displays, such as beamspreading and atmospheric effects, which can be incorporated in the simulated display. An analysis of the methods of characterizing cultural, as opposed to natural features in the simulator to provide increased realism is presented. Author

N64-21811 Naval Ordnance Test Station, China Lake, Calif.
MODEL 5 TRACKER AND PROFILE PLOTTER, SKY-SCREEN TELESCOPES, AND ASSOCIATED ELECTRICAL EQUIPMENT: DESCRIPTION, OPERATION, AND MAINTENANCE A Preliminary Manual
C. E. Wilson, E. B. Hill, and George Thompson Feb. 1964 100 p
(NOTS-TP-3330; AD-435870)

New instrumentation, designed and developed to assist pilots in more effective loft-bombing techniques, provides the following information: ground speed, profile of the aircraft flight path in the vertical plane, location of the aircraft relative to the target at the time of pullup and in the vertical plane at the time of bomb release, location of the bomb impact in relation to the target to an accuracy of 10 ft, and the amount the aircraft flight path deviates in the vertical plane from the optimum profile path during its maneuver. This manual provides complete descriptions of all component parts of the instrumentation and instructions for handling and maintenance. A.W.

N64-21820 Boeing Co., Seattle, Wash. Chance Vought Corp.
X-20 (DYNA SOAR) NOSE CAP HYPERTHERMAL TEST APPARATUS—DESCRIPTIVE REPORT
F. H. Goodnight 9 Dec. 1963 27 p refs Prepared by Chance Vought Corp. for Boeing Co.
(Rept.-311.11; CV-50591-RI; AD-433937)

A hyperthermal test apparatus was constructed as a tool to use in demonstrating the integrity of the X-20 Dyna Soar nose cap. The apparatus produces realistic simulation of X-20 reentry thermal environments for environmental testing. Simulated reentry heat fluxes are supplied by convection heating and by a radiation shroud that limits the heat radiated away by the specimen. Convection heating is supplied by the products of combustion of oxygen and propane. Heating rates are controlled by a variable flame temperature to reproduce the time variation of nose cap temperatures that will be experienced by the flight article. Acoustic and boundary layer oxidation environments are also simulated. Author

N64-21999 Pacific Missile Range, Point Mugu, Calif.
PACIFIC MISSILE RANGE MANUAL. VOLUME III: RANGE FACILITIES AND INSTRUMENTATION
1 Aug. 1963 104 p
(PMR-MP-63-7; AD-433096)

The Pacific Missile Range (PMR) was established for launching, tracking, and collecting data in guided-missile and space-vehicle programs. To implement this mission, PMR maintains sites along the California coast and in the central Pacific Ocean. This volume sets forth the capability of the range by describing facilities that are, or soon will be, operational, and is composed of the following sections: (1) Range-area capability—each site is shown on a map or on an aerial photograph, and major range-support facilities are described briefly. For each site, a table lists installed equipment and furnishes general information on the capabilities of the site. (2) Mobile facilities—range ships, mobile instrumentation vans, and instrumentation aircraft (which make up the mobile facilities of the range) are described. (3) Range instrumentation systems—the different instrumentation systems employed by the PMR and methods by which they are tied together to support program requirements are described. Detailed information on performance characteristics of individual equipment used within a system is tabulated. I.v.L.

N64-22138 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INCREASING THE HEAT OUTPUT OF GAS-COOLED REACTORS
Laszlo Perneczky 13 May 1963 16 p Transl. into ENGLISH from Energia es Atomtech. (Hungary), no. 8, 1962, p 375-380
(FTD-TT-63-114/1+2+3+4; AD-405698)

This report incorporates the investigation concerned with the thermal-engineering calculations and the results for a Calder–Hall type reactor cooled by carbon dioxide gas. The purpose of the investigation was to determine the quantity of the heat that could be taken off from the reactor under various sets of conditions, with the total amount of gas being held constant. N.E.A.

N64-22154 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A SPIRAL-BAND HEAT EXCHANGER
N. V. Zhutautas 9 Jan. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 138259 (668191/28), 27 May 1960
(FTD-TT-62-292/1+2+4; AD-295450)

A spiral-band heat exchanger with spiral and axial channels for conveying two heat-exchanging media is described. Each section of the device is a system of channels arranged in spiral loops in which one of the streams of the heat changing media moves from the center of the channel to the periphery with a consequent reverse change in the direction of its travel. This construction of the heat exchanger improves the temperature in the axial channels of the section. N.E.A.

N64-22179 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEMS INVOLVED IN THE TOTAL ELECTRIFICATION OF THE USSR AND TECHNICAL PROGRESS IN POWER ENGINEERING
P. S. Neporozhniy 27 Dec. 1963 55 p Transl. into ENGLISH from the Book "Problems Sploshnoy Elektrifikatsii SSSR i Tekhnicheskiy Progress v Energostroitel'stve" Moscow, Gosenergoizdat., 1960 p 3-45
(FTD-TT-63-820/1+2; AD-435499)

A general review of methods of organizing the construction of electric powerplants and of the complex problems involved in the total electrification of the U.S.S.R. is presented. The problems considered include the choice of the type of fuel, the distribution of electric powerplants, the improvement of the technical equipment, and the cost reduction and quality

control through the use of mechanization and prefabrication in the construction of these plants. M.P.G.

N64-22224 Advisory Group for Aeronautical Research and Development, Paris (France)
JET SIMULATION IN GROUND TEST FACILITIES
M. Pindzola Nov. 1963 66 p refs
(AGARDOGRAPH-79)

This paper presents a review of various techniques employed in the simulation of a jet exhaust in ground test facilities. A brief summary of the characteristics of a jet exhausting into both quiescent and moving media is presented. The importance of duplicating the initial inclination angle of the jet, δ_j, when conducting simulation studies is pointed out. Various scaling parameters are enumerated. A requirement for the duplication of the jet pressure ratio, jet momentum, and the parameters $\gamma_j M_j^2/\beta_j$ and $(RT)_j$ is indicated. Experimental data are also presented that verify the importance of these parameters in simulation studies. One method of selecting the geometry and test conditions for a simulation model in order to account for a difference in γ_j between model and full scale and still duplicate the important similarity parameters is presented. Author

N64-22378 Aerospace Corp., El Segundo, Calif. Manned Systems Div.
TITAN III INTEGRATED ELECTRONIC AEROSPACE GROUND EQUIPMENT
Leonard Chevlin 1 Jun. 1964 43 p
(Contract AF 04(695)-269)
(SSD-TDR-64-35; TDR-269(4116-52)-1; AD-441102)

The design philosophy that guided the development of an integrated checkout and launch control system for the Titan III Standard Space Launch Vehicle (SSLV) is presented along with the requirements and intended use of the operational space system support equipment. Various concepts are presented to alert support equipment designers to the various factors that require consideration to achieve the optimum design solution. The Titan III operational ground-based system includes all support equipment required within the operational logistic flow from factory through launch. The specific areas involved in the logistic flow include factory operations, storage and transportation, depot support center, and launch complexes. The primary problems involved in integrating SSLV checkout and launch control equipment, and solutions to these problems, are discussed. Cost criteria, risk factors, checkout criteria, and the purpose and function of the major aerospace ground equipment (AGE) items are presented. Author

N64-22537 Naval Ordnance Test Station, China Lake, Calif. Test Dept.
TRANSONIC AERODYNAMIC TRACK TESTING
W. J. Stronge Sep. 1963 31 p refs
(NOTS-TP-3316; NAVWEPS-8398; AD-423189)

The design, analysis, and operation of a rocket sled to conduct transonic aerodynamic track tests of a full-scale missile are reported. The sled was designed to use a low-frequency rubber suspension system to isolate track-induced vibrations. This necessitated dynamic stability and six-degree-of-freedom vibration analyses. A three-axle sled allowed the suspension system to remain decoupled despite changes of mass. Onboard instrumentation to record test measurements included high-speed cameras and semiconductor-type strain gages. In these tests, control-fin hinge moments and the lift, drag, and center-of-pressure of the missile as functions of speed and angle-of-attack were successfully measured. Author

N64-22607 ARO, Inc., Arnold Air Force Station, Tenn.
KNIFE-EDGE CONTROLLER FOR A SCHLIEREN SYSTEM
C. B. Wells Arnold Eng. Develop. Center, Jun. 1964 23 p
(Contract AF 40(600)-1000)
(AEDC-TDR-64-126; AD-441303)

A device has been developed to alleviate the effects of vibration induced into the schlieren system of a 40-in. supersonic tunnel. The merits of using a closed-loop servosystem for knife-edge control, to compensate for vibrations in a schlieren system, are demonstrated. Included is a discussion of the schlieren-system optics that compares the monitor light to the schlieren light path and illustrates the purpose of a monitor light source for control purposes. A brief explanation is given of the servosystem and the method by which it positions the knife edge in response to the changes in light as sensed by a detector. Author

N64-22620 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
A SHOCK TUBE FOR PRODUCING SUBSONIC, TRANSONIC, AND SUPERSONIC FLOWS FOR AERODYNAMIC TESTING
R. L. Varwig 18 Feb. 1963 21 p refs
(Contract AF 04(695)-169)
(SSD-TDR-63-32; TDR-169(3230-11)TN-9; AD-403045)

A shock tube is proposed in which the flow conditions between the shock wave and advancing interface are expected to range from low subsonic to moderate supersonic speeds. Furthermore, testing times of 10 msec or more are predicted, a time quite adequate for aerodynamic force measurements. The driven section in the proposed facility is large enough to accommodate large-scale models. To test the feasibility of the proposed tube, a shock tube was assembled using a surplus 7-ft-diam vacuum tank as a driven section and 12-in. flanged pipe for the driver. A series of tests were performed to determine shock formation time and experimental testing time. The results of these tests are reported. Author

11 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; 13 Heat Transfer and Thermodynamics; and 24 Physics, Plasma.

N64-21557 Avco Corp., Wilmington, Mass. Research and Advanced Development Div.
HYPERSONIC LAMINAR WAKES AND TRANSITION STUDIES
A. J. Pallone, J. I. Erdos, and J. Eckerman 25 Nov. 1963 66 p refs
(Contract AF 04(694)-239; Proj. Rest)
(RAD-TM-63-33, Rev. 1; AD-434433)

This report presents the results of theoretical and experimental investigations of the flow in the wake of hypersonic vehicles. Nonsimilar solutions of the equations governing the far wake are obtained and contrasted with similar solutions and with solutions involving the Karman–Pohlhausen approach. Numerical examples of the flow field in the wake of ballistic-range and wind-tunnel models and of a flight-size vehicle are presented. A series of ballistic-range experiments with conical models of 10°, 15°, and 27 1/2° half angles are described. The

model velocity ranges between 4,000 and 17,000 fps with range pressures varying from 15- to 380-mm Hg in air. The experimental data are discussed in detail, and the analysis is used to compute and correlate appropriate transition parameters. Author

N64-21615 Los Alamos Scientific Lab., N. Mex.
THEORY OF CORRESPONDENCE BETWEEN FLUID DYNAMICS AND PARTICLE-AND-FORCE MODELS
Francis H. Harlow 17 Jan. 1963 28 p refs
(Contract N-7405-ENG-36)
(LA-2806) OTS: $0.75

Analysis was undertaken to demonstrate the basis for expecting success in the completely statistical class model, and in addition, to show how to choose the interparticle force function to correspond to a given material equation of state. The method of analysis employs a many-particle distribution function equation whose reduction is accomplished through the assumption of two-body forces and of strong correlations with the mean. Primary results include correspondence equations between conservative force function and equation of state, and between dissipative force function and viscous stress. Solutions are given for the first type of correspondence equation, and comparisons are made with previous heuristic studies. Author

N64-21618 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Lab.
THE MAGNETIC O_2- ANALYSIS IN GAS MIXTURES
Hermann Rein Mar. 1964 25 p refs Transl. into ENGLISH from Pflügers Arch. (Gottingen, W. Germany), v. 247 p 576–592
(MH-Transl.-504)

Discussed is the basis of a method for the analysis of O_2 in gas mixtures, using the viscosity variations of O_2 in the magnetic field. Flow resistance is measured in a capillary arrangement analogous to the Wheatstone bridge for electric resistances. The measuring accuracy of the differential pressure gage used lies, for a reliable zero point position, at 0.00016-mm H_2O. The deflection of the bridge differential pressure gage yields, under consideration of the applied pressure drop, direct data about the magnitude of the magnetic viscosity variation in gas mixtures. The variation of $(\Delta\eta/\eta)$ is obtained for pure O_2 at a barometric pressure of 755-mm Hg and at room temperature in a field of 3,500 gauss at $13.3 \cdot 10^{-4}$. The presence of CO_2 influences the quantitative values of O_2 by reducing the magnetic viscosity effect. Author

N64-21657 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE DEPENDENCE OF THE COEFFICIENT OF CONSERVATION OF PRESSURE OF A RETARDED FLOW Σ ON THE VELOCITY FACTOR ϕ IN THE SUPERSONIC SECTION OF A LAVAL NOZZLE WITH INCOMPLETE AND COMPLETE EXPANSION OF THE GAS IN THE NOZZLE
V. S. Ivanov (Kazan State U.) 22 Jan. 1963 12 p ref Transl. into ENGLISH from Aviatsionnaya Tekhnika (USSR), no. 1, 1962 p 75–81
(FTD-TT-62-1643/1+2+4; AD-298237)

Expressions for the gas flow rate in a nozzle with fixed cross-sectional areas in the critical and outlet cross sections are developed for two flow conditions—flow without pressure loss in the supersonic section, and flow with pressure losses in the supersonic section of the nozzle. P.V.E.

N64-21663 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
APPROXIMATION METHOD OF COMPUTING THE THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER
V. S. Avduyevskiy 27 Mar. 1964 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 2, 1962 p 11–16
(FTD-TT-63-1136/1; AD-600524)

A method is described for computing the three-dimensional boundary layer formed on the surface of an intensely cooled, blunt body embedded in a hypersonic flow. This method begins with the construction of a coordinate system on the surface of a body, the determination of Lamé's coefficients, modification for intense cooling, adaptation for flow on a cone, and consideration of the space flow along the line of expansion. D.E.W.

N64-21699 Aeronautical Research Council (Gt. Brit.)
PROGRESS REPORT ON AN EXPERIMENT ON THE EFFECT OF SURFACE FLEXIBILITY ON THE STABILITY OF LAMINAR FLOW
N. Gregory and Edna M. Love London, HMSO, 1962 31 p refs
(ARC-CP-602; Previously issued as ARC-23-314)
HMSO: 4s 6d

This paper describes the flexible surfaces whose properties have been examined and tested on an airfoil in a wind tunnel. The experiment has been inconclusive as no drag reductions have been found in turbulent flow; the only rearward movements of transition occurred in conditions where the alteration has been inhibited by the onset of laminar separation. The limitations of the experiment are discussed carefully in order to clarify the next steps to be taken with more flexible surfaces and with less damping. Author

N64-21719 Naval Ordnance Lab., White Oak, Md.
ON THE EFFECT OF TRANSVERSE CURVATURE IN COMPRESSIBLE LAMINAR BOUNDARY LAYER FLOW OVER SLENDER BODIES OF REVOLUTION Aerodynamics Research Report 195
Jan Raat Jun. 1964 32 p refs
(NOLTR-63-68; AD-600987)

The effect of transverse curvature on the compressible laminar boundary-layer flow over slender axisymmetric power-law bodies is investigated by employing the momentum integral technique. Pressure gradients are neglected, and the body surface is assumed to be insulated. Asymptotic solutions for the skin friction coefficient are derived in the regimes of weak and strong curvature effects. A numerical integration, covering the entire range of curvature effects, has been carried out for the cone. Author

N64-21734 General Electric Co., Schenectady, N.Y. Research Lab.
VIBRATIONAL RELAXATION AND RECOMBINATION OF NITROGEN AND AIR IN HYPERSONIC NOZZLE FLOWS
H. T. Nagematsu and R. E. Sheer, Jr. Sep. 1963 53 p refs
(Sponsored in part by AF)
(Rept.-63-RL-(3429C))

The effects of vibrational relaxation and recombination of high-temperature nitrogen and air were investigated in a hypersonic shock tunnel at high flow Mach numbers. The equilibrium temperature and pressure ranges after the reflected shock wave were 1,400° to 7,000° K and 100 to 500 psia. Static pressure measurements were made along the axis of the nozzle

to determine the freezing of the vibrational mode during the expansion process. Vibrational relaxation times for nitrogen obtained from shock tube experiments were used to calculate the relaxation length. A criterion has been developed for predicting the vibrational freezing point in the nozzle based upon the relaxation length determined for an equilibrium flow assumption. Once the nitrogen vibrational mode freezes in the expansion region, there is very little exchange of the vibrational energy into the translational and rotational energies. Author

N64-21743 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

UNSTEADY BOUNDARY LAYER THEORY

V. V. Struminskiy 13 Jan. 1964 44 p refs Transl. into ENGLISH from SB. Teor. Rabot Po Aerodinamika (Moscow), 1957 p 230–252

(FTD-TT-63-778/1+2+4; AD-432065)

This work presents the general theory of an unsteady boundary layer on profiles of an arbitrary shape and on solids of revolution. Methods of calculating an unsteady boundary layer are given. An exact solution is found for a flat plate. Author

N64-21789 Technion Research and Development Foundation Ltd., Haifa (Israel)

BASE PRESSURE BEHIND TWO-DIMENSIONAL AND AXIALLY SYMMETRIC BACKWARD FACING STEPS IN A TURBULENT SUPERSONIC FLOW Scientific Report No. 4

J. Rom and M. Victor Dec. 1963 29 p refs

(Contract AF 61(052)-576)

(TAE-31; ARL-64-67; AD-434823)

The pressure behind a two-dimensional step in supersonic turbulent flow is calculated by the use of the Crocco–Lees momentum integral method. However, instead of assuming a constant mixing rate of $k = 0.03$, it is assumed that $\overline{C}_t$ = constant. This assumption considers the turbulent mixing to be similar, in general, to the laminar case except for the much higher mixing rate. The assumption of $\overline{C}_t$ = constant leads to a similarity parameter for the pressure behind a two-dimensional step equal to $Re_L^{-3/5}h/L$. Pressure distribution behind two-dimensional steps is measured at Mach number of 2.25 and Reynolds numbers between 0.35×10^6 to 5×10^6. Good agreement is found between the analytical calculations and the experimental data as well as other published experimental data. Pressure distribution behind axially symmetric backward-facing steps is measured at Mach number 2.25 and Reynolds number of 3×10^6 to 10×10^6. It is shown that the flow around the axially symmetric step is similar to that about a free base and is thus correlated using the parameter $Re_L^{1/5}h/L$. Author

N64-21918 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

LIMITS OF STABLE EXISTENCE OF POSITIVE GAS DISCHARGE COLUMN

I. A. Poletayev 28 Nov. 1962 15 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (Leningrad), v. 21, no. 9, 1951 p 1021–1028

(FTD-TT-62-1238/1+2; AD-292664)

The conditions necessary for the existence of an independent gas discharge at very low pressures and the causes of the extinction of the discharge are investigated. Gases investigated include mercury, potassium, argon, neon, and helium. P.V.E.

N64-21934 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METHOD OF CONSIDERING RELAXATION IN THE PROBLEM OF DIRECTING A FLOW AROUND A CONE

V. N. Arkhipov and K. S. Khoroshko 22 Jul. 1963 9 p refs Transl. into ENGLISH from Zh. Mekhan. i Tekhn. Fiz. (Moscow), no. 6, 1962 p 121–124

(FTD-TT-63-655/1+2; AD-415140)

It is necessary to consider the deviation from equilibrium when a gas passes through a main shock wave. In this case, the problem of a flow around a cone becomes two-dimensional because the characteristic linear dimension appears to be dependent on the magnitude of the relaxation zone. A method for considering relaxation in the problem of supersonic flow around a cone is considered. The method described is inapplicable in the zone of small changes in parameters, that is, where the parameters are almost the same as their equilibrium values. R.T.K.

N64-21966 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INTEGRAL-MOMENT METHOD OF SOLVING THE BOLTZMANN KINETIC EQUATION

M. N. Kogan 3 Dec. 1963 12 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 3, 1963 p 36–40

(FTD-TT-63-1033/1+2; AD-426896)

A method is described that enables the computation of the flow of a gas, in principle, with an arbitrary Knudsen number. The method is convenient for solving problems where the Knudsen numbers are not too small ($a < K < \infty$, where $0 < a < 1$). I.v.L.

N64-21981 Aerospace Research Labs., Wright-Patterson AFB, Ohio Thermomechanics Research Lab.

ELECTRO-FLUID DYNAMIC ENERGY CONVERSION PROCESSES FOR POWER GENERATION

S. Hasinger, M. Hawes, M. O. Lawson, H. J. P. Von Ohain, and F. L. Wattendorf [1964] 41 p refs Presented at the 6th AGARD Combust. and Propulsion Colloq. on Energy Sources and Energy Conversion, Cannes, France, 16–20 Mar. 1964

(ARL-64-61; AD-434089)

In these processes fluid dynamic energy is directly transformed into electrical energy by passing a working medium containing ions or charged colloids through an electrostatic field. Two coupling methods used to transport one elementary charge against the high field strength in the conversion section of a converter are discussed in detail: (1) viscous coupling between the working substance and the electric charge carriers; and (2) rigid coupling between the electrical charges and the working medium. Results of investigating viscous coupling show that very favorable power densities and stage efficiences can be obtained with viscous electrofluid dynamic processes that (1) employ electrode and channel configurations with aerodynamic shapes having a very small drag loss, and (2) utilize pressurized working gases of low average molecular weight and high dielectric strength that contain charged colloids of one polarity. With respect to rigid coupling, some fundamental performance characteristics of a ballistic generator are discussed in particular, and ballistic conversion principles based on both infinite plane electrode configurations and axisymmetrical ones are discussed in general. P.V.E.

N64-21983 United Technology Corp., Sunnyvale, Calif.
DYNAMICS OF TWO-PHASE FLOW IN ROCKET NOZZLES Eleventh Quarterly Technical Progress Report, 1 Nov. 1963 – 31 Jan. 1964
C. T. Crowe, R. W. Woolfolk, R. Dunlap, R. W. Hermsen, and P. G. Willoughby 27 Feb. 1964 51 p refs
(Contract NOw-61-0760-c)
(UTC-2005-QT11; AD-431589)

An experimental and theoretical investigation of the axial and radial velocity lag of a dispersed solid phase in accelerating gases is being conducted. Development has continued of the experimental apparatus to measure particle drag coefficients in the regimes of particle Mach numbers < 2 and Reynolds Numbers < 100. Pressure distribution measurements were continued on the two-dimensional nozzle with pure gas flow in preparation for measurements with gas-particle flow. A preliminary study of the nucleation and growth of an aluminum oxide particle has been conducted. Approximate calculations show that the smallest Al_2O_3 particle to be found in the chamber is of the order of 0.01μ in diameter. Further calculations show that particle agglomeration owing to Brownian motion provides a rapid mechanism from the growth of particle from 0.01μ to about 0.1μ. Differential mass flow and particle-size measurements were continued with the double-nozzled rocket motor. Charts are presented that provide the correction for particle solidification for the series of vacuum specific impulse efficiency charts presented previously. Author

N64-22007 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Div.
SEPARATION AND REATTACHMENT OF SUPERSONIC TURBULENT BOUNDARY LAYER BEHIND DOWN STREAM FACING STEPS AND OVER CAVITIES
G. J. Thomke Mar. 1964 138 p refs
(SM-43062)

Surface pressure measurements were obtained for the flow regimes created when a turbulent boundary layer in supersonic flow separates over the classical downstream-facing step and over a cavity. The experiments were conducted in the Mach number range 2.0 to 4.0 on a model having a ducted, 1-ft diam, axisymmetric body. In general, the pressure rise at reattachment was found to be in good agreement with Korst's theory. The shape and scale of the reattachment pressure distribution are influenced considerably by Mach number. Reattachment occurs at a point where the pressure rise is about 50% complete. A point of flow reversal is found upstream of the reattachment point. Recompression shoulder shape, cavity length, and Mach number influence the strength of the acoustic radiation emitted from the cavity and the pressure drag on the model. R.T.K.

N64-22087* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VELOCITY CORRELATIONS IN WEAK TURBULENT SHEAR FLOW
Jay Fox Repr. from Phys. Fluids, v. 7, no. 4, Apr. 1964 p 562–564 refs
(NASA-RP-194)

Spectra of turbulent energy components in a uniform shear flow with weak, homogeneous turbulence are presented. The components reported complement Deissler's calculations for the case of initially isotropic turbulence, and together with Deissler's calculations they provide a description of the effects of the mean-velocity gradient. IAA

N64-22164 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE SUPERPOSITION OF ORDINARY STEADY FLOWS WITH A LIMITED AFTEREFFECT
N. P. Buslenko 23 Jan. 1963 8 p refs Transl. into ENGLISH from Problemy Peredachi Informatsii, Laboratoriya Sistem Peredachi Informatsii, AN SSSR, no. 9, 1961 p 79–82
(FTD-TT-62-1383/1+2+4; AD-297572)

Formulas associated with the superposition of ordinary steady flows with a limited aftereffect are derived. Author

N64-22198 Princeton U., N.J. Plasma Physics Lab.
ASYMPTOTIC THEORY OF THE POSITIVE COLUMN OF A QUIESCENT, LONGITUDINALLY UNIFORM GAS DISCHARGE
Ira M. Cohen and Martin D. Kruskal Jul. 1963 134 p refs
(Contract AT(30-1)-1238)
(MATT-202)

A qualitative description of typical gas discharges is given, with a brief discussion of the fundamental phenomena involved. The specific problem treated is the steady-state analysis of the positive column of a glow discharge using the equations governing the diffusion of charged particles in a force field together with Poisson's equation. This problem is discussed physically and formulated mathematically. A critical review of the relevant literature is given. Several asymptotic limits are discussed—$D_+/D_- \to 0$, $T_-/T_+ \to \infty$, electron density at the centerline of the discharge $\to 0$ and ∞, and $D_+/D_- \to 1$, $T_-/T_+ \to 1$. Author

N64-22212 Stanford U., Calif.
THE COMPRESSIBILITY EFFECT OF A GAS STREAM ON THE STABILITY OF AN ADJACENT LIQUID LAYER Technical Report No. 10
I-Dee Chang and P. E. Russell Dec. 1963 100 p refs
(Contract Nonr-225(30))
(SUDAER-172; AD-434717)

The interfacial stability of a liquid layer with a compressible gas flowing over it is investigated. The liquid is assumed to be incompressible and inviscid, and the gas to be inviscid and to obey the equations of linearized compressible flow theory. The effects of surface tension at the gas–liquid interface and a gravitational body force are included. Interfacial stability is analyzed by means of a steady-gas-motion approximation. The effects of viscosity, surface tension, gravity, and finite liquid–layer depth are discussed. The analysis is extended to include unsteady gas motion, but neglects viscosity and gravity effects. Assuming the gas to be air and the liquid layer to be Pyrex glass 0.5 cm. deep, stability curves are plotted for three values of the gas density. Author

N64-22264 Lockheed Missiles and Space Co., Sunnyvale, Calif.
INVISCID, NONADIABATIC FLOW ABOUT BLUNT BODIES Technical Report: Flight Sciences
R. H. Wilson and H. Hoshizaki Jan. 1964 54 p refs
(LMSC-6-90-64-1)

The problem considered is that of determining the inviscid, nonadiabatic flow field that results when energy loss by radiation becomes significant. The approach taken is to include the radiation term in the energy equation and then to solve the resulting conservation equations for the flow past a blunt body. The direct blunt-body problem is solved by using an integral method. Results were obtained for the flow about a sphere and a hemisphere-cone, under conditions where large energy loss from the shock layer occurs. The nonadiabatic nature of such a flow was found to significantly reduce the shock-layer thickness about the body and to alter the enthalpy profiles within the shock layer. The velocity field is affected to a much smaller extent. The radiative heat transfer about the body was calculated, and results are included. R.T.K.

N64-22285 United Nuclear Corp., White Plains, N.Y. Development Div.
HIGH VELOCITY CONDENSING Technical Report, 1 Mar. 1962–31 Jan. 1963
T. D. Hawkins and R. Hankel Wright-Patterson AFB, Ohio, ASD, Apr. 1964 133 p refs
(Contract AF 33(657)-8420)
(UNC-5047; ASD-TDR-63-397; AD-437888)

A program has been conducted to investigate, analytically and experimentally, changes in stagnation conditions of a condensing fluid moving at high subsonic or supersonic velocities. The results of this investigation have shown that, under certain heat transfer and flow conditions, a rise in the stagnation pressure of the flowing stream can be achieved. The analytical studies have included homogeneous and nonhomogeneous flow models. Calculations of stagnation conditions (pressure, temperature, and quality) have been performed for liquid–vapor mixtures of potassium and water, using both flow models. Analysis has also been made of the change in stream properties of a two-phase mixture across a normal shock. Author

N64-22288 General Motors Corp., Santa Barbara, Calif. GM Defense Research Labs.
INVESTIGATION OF PRECURSOR IONIZATION IN FRONT OF THE SHOCK WAVES OF HYPERSONIC PROJECTILES Technical Report
Srbislav Zivanovic Sep. 1963 32 p refs Presented at the AIAA Conf. on Physics of Entry into Planetary Atmospheres, MIT, Cambridge, 28 Aug. 1963
(Contract DA-04-495-ORD-3567(Z); ARPA Order 347-63)
(TR63-217E; AD-423930)

An experimental attempt has been made to measure the precursor electron density as a function of distance ahead of the shock front of hypersonic projectiles in a ballistic range. The electron density just preceding the shock front has been measured as a function of projectile velocity and of ambient pressure. For velocities up to 6,700 m/sec and pressures up to 30-mm Hg the measured density of electrons in the vicinity of the shock front is of the order of 10^9 e/cm^3. The maximum electron density of the precursor ionization increases almost exponentially with velocity. At a fixed pressure, the electron density increases about 30 times for an increase of velocity from 5,300 to 6,700 m/sec (18,000 to 22,000 fps). The electron density also increases with pressure. Author

N64-22300 Polytechnic Inst. of Brooklyn, Freeport, N.Y.
THE LAMINAR BOUNDARY LAYER WITH HYDROGEN INJECTION INCLUDING MULTI-COMPONENT DIFFUSION
Paul A. Libby and Mauro Pierucci Wright-Patterson AFB, Ohio, ARL, Mar. 1964 48 p refs
(Contract AF 33(616)-7661)
(ARL-64-40; AD-600862)

A laminar flow is treated that is simple from the fluid mechanical and chemical points of view, but that involves multicomponent diffusion and relatively accurate transport properties. A similar boundary layer with hydrogen injection and with chemical behavior idealized according to the flame sheet model is considered. On the basis of several numerical examples the present analysis predicts boundary-layer behavior significantly different from that given by analyses with simple transport; e.g., the velocity profiles with hydrogen injection resemble suction profiles because of the reduction in the $\rho\mu$ product. Accordingly, the accuracy of existing analyses involving species with a spectrum of molecular weights and employing the assumption of simple transport properties would appear doubtful. Author

N64-22311 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ANALYSIS OF THE OPTIMUM PERFORMANCE OF BUFFERED SHOCK TUBES Interim Technical Report, May 1962–Jul. 1963
Bruce H. Fetz Wright-Patterson AFB, Ohio, ARL, Mar. 1964 111 p refs
(Contract AF 33(657)-8860)
(ARL-64-41; AD-601114)

For the case of strong shocks the number of variables needed for the analysis of buffered shock tubes is reduced to 3. An expression is obtained from which the buffer conditions necessary for the production of the maximum shock Mach number are determined. The strong shock analysis is extended to include shock tubes with many buffers and buffered shock tubes with area changes at either or both diaphragms. The concept of using a detonable mixture as a buffer gas is explored, and its limitations are indicated. Also, a study is included of different shock tube geometrical configurations to indicate means of achieving the maximum testing time. Author

N64-22312 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
THE EFFECT OF AMBIENT DISSOCIATION ON NONEQUILIBRIUM SHOCK LAYERS Interim Technical Report 2
W. H. Gibson Wright-Patterson AFB, Ohio, ARL, Mar. 1964 66 p refs
(Contract AF 33(657)-8860)
(ARL-64-42; AD-601087)

The effects of ambient dissociation in a hypersonic free stream are examined for inviscid, nonequilibrium shock layers. The profiles of atom concentrations behind the bow shock are compared with those obtained for an undissociated free stream. Two types of correlations are developed, for fixed enthalpy and for fixed flight speed. For fixed enthalpy, the effect of ambient dissociation is shown to decay rapidly behind the shock. For fixed flight speed, the correlation is expressed by a simple subtraction of the ambient dissociation fraction. The subtraction rule preserves the gas temperature, and its validity does not depend on a particular choice of the rate coefficient. The correlations are established for the simplified chemical model of a Lighthill gas. They are also extended to airflows with coupled chemical reactions. In this latter case, the application of the subtraction rule requires that the total oxygen content of the dissociated free stream be properly adjusted. The mixture must be richer in oxygen than the atmospheric proportion. The predicted correlations are verified on the basis of available numerical solutions for coupled air chemistry. The implications of the results are noted concerning simulation of real-gas effects. Author

N64-22332 United States Rubber Co., Wayne, N.J. Research Center
LITERATURE SEARCH INTO METHODS OF DAMPING OUT INCIPIENT TURBULENCE IN THE FLOW OF LIQUIDS Final Report
J. Thompsen, F. W. Boggs, and N. Tokita 9 Jan. 1964 31 p refs
(Contract DA-30-069-AMC-287(T))
(AD-427728)

The problem of delaying transition from laminar to turbulent flow has long been under investigation. This report presents a bibliography on the work done for the last 50 years on the transition problem specifically for incompressible flow over flat plates or in pipes. The articles included in this list are concerned with the mechanism of transition and

transition delay. Recent research has indicated that the addition of non-Newtonian additives to the flow may be a promising way of delaying transition in piping systems, such as hydraulic line, normally found in industry. Reduction of noise in pipes is possible by the use of flexible surfaces. Author

N64-22346 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF DISPERSE ATOMIZATION IN NOZZLES OPERATING ON THE PRINCIPLE OF THE BILATERAL WASHING OF A LIQUID SURFACE WITH GAS
I. G. Plit 15 May 1963 21 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow, v. 35, no. 9, 1962 p 1996–2007
(FTD-TT-63-290/1+2+4; AD-413583)

In investigating the influence of the basic parameters on the dispersion of liquid sprays in low-pressure pneumatic nozzles, it was established that there are two characteristic regions, depending on atomization conditions, in which the mean drop diameter changes according to various regularities. Generalized equations were obtained for each region. N.E.A.

N64-22350 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF THE MICRORELIEF OF THE CONFORMITY TO LAW OF THE DISTRIBUTION OF LIQUID METAL OVER A HARD METALLIC SURFACE
Yu. V. Goryunov, N. V. Pertsov, B. D. Summ, and Ye. D. Shchukin 28 May 1963 10 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 146, no. 3, 1962 p 638–641
(FTD-TT-63-384/1+2; AD-409950)

A brief discussion is presented of a study of the spreading of mercury over a surface of semicrystalline zinc, free from an oxidized film. P.V.E.

N64-22364 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRINCIPLE OF TURBULENT MIXING OF COAXIAL FLOWS IN A CHANNEL OF CONSTANT CROSS SECTION
O. V. Yakovlevskiy 25 Mar. 1964 21 p refs Transl. into ENGLISH from Inz. Zh., (USSR), v. 1, no. 4, 1961 p 39–50
(FTD-TT-63-1139/1+2+4; AD-600237)

A method for calculating the flow in the secondary zone of a mixing chamber is presented. This method reduces the calculation method to the determination of three unknowns—two values of velocity, u_m and u_2, where u_m is the velocity along the axis of the channel and u_2 is the velocity close to the wall, and a static pressure p as a function of the longitudinal coordinate x. I.v.L.

N64-22386 ARO, Inc., Arnold Air Force Station, Tenn. Aerospace Environmental Facility
CAPTURE COEFFICIENTS AND SHOCK STRUCTURE FOR A LHe AND LNe COOLED CRYOPLATE IN A MACH 3 LOW DENSITY AIR STREAM
J. A. Collins, Jr. Arnold Eng. Develop. Center, Jun. 1964 28 p refs
(Contract AF-40(600)-1000)
(AEDC-TDR-64-124; AD-601376)

Results are presented of a test program designed to study the capture coefficient of a liquid-helium- and liquid-neon-cooled cryoplate exposed to a Mach-3 low-density airstream. Capture coefficients are given for both a flat plate and an 80° half-angle conical plate placed normal and at an angle-of-attack to the airstream for the cases with and without a scaled fairing in front of the plates. Also presented are the effects on the shock structure in front of the plate when the plate is cooled to 4.2° K. Author

N64-22441 Illinois U., Urbana
INTERACTION BETWEEN PRIMARY AND SECONDARY STREAMS OF SUPERSONIC EJECTOR SYSTEMS AND THEIR PERFORMANCE CHARACTERISTICS
W. L. Chow and A. L. Addy (Ph.D. Thesis) Repr. from AIAA J., v. 2, no. 4, Apr. 1964 p 686–695 refs
(Grant NsG-13-59)

The flow phenomena corresponding to various flow regimes are described and analyzed. Fluid flow problems of such a nature are basically governed by the mutual interactions between the primary and the secondary streams, and the viscous effects cannot be neglected, especially when the secondary flow rate is small. The performance characteristics of such ejector systems are presented as three-dimensional surfaces; thereby the influence of the individual parameters on the flow phenomena can be easily interpreted. With the flow model here proposed, the transition between various flow regimes can easily be visualized. In particular, numerical calculations have been carried out for ejector systems with cylindrical shrouds, and the results are also verified experimentally. Extension of this analysis to cases of ejector systems with different stagnation temperatures and fluid compositions between the primary and the secondary streams is also mentioned. I A A

N64-22481* Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
RESONANCE ABSORPTION SPECTROPHOTOMETRY OF THE HYDROGEN ATOM BEHIND SHOCK WAVES
A. L. Myerson, H. M. Thompson, and P. J. Joseph May 1964 54 p refs
(Contract NASr-109)
(NASA-CR-56290; CAL-AD-1689-A-3) OTS: $5.60 ph

The rate of formation of atomic hydrogen behind an incident shock wave in hydrogen–argon mixtures was followed directly by atomic absorption spectrophotometry. The absorption involved the strong, resonance transition of the hydrogen atom from its ground state to the first excited level. The development of a cool, low-pressure source of Lyman α radiation was required so that the half-width of the source line could be considered thin when compared with that of the same line in absorption arising from the hydrogen atoms behind the shock front. Preliminary rates were calculated and provide evidence for dissociation catalyzed by oxygen. Author

N64-22497 Southwest Center For Advanced Studies, Dallas, Tex.
HYDROMAGNETIC STABILITY AT A FLUID VELOCITY DISCONTINUITY BETWEEN COMPRESSIBLE FLUIDS
J. A. Fejer Repr. from Phys. of Fluids, v. 7, no. 4, Apr. 1964 p 499–503 refs
(Grant NsG-269-62)

Formal conditions are derived for the stability of a velocity discontinuity at a plane interface between two perfectly conducting, inviscid, compressible fluids, in the presence of uniform magnetic fields. Certain special cases, in which the stability conditions can be simplified, are discussed in detail. Previous results for incompressible fluids are rederived, and it is shown that the introduction of a slight compressibility always reduces the stabilizing effect of magnetic fields. It is further shown that in two special cases the magnetic field required to stabilize an interface continues to increase with the introduction of more compressibility until it reaches a limiting value that is about twice as large as the value appropriate to incompressible fluids. Author

N64-22529 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INVISCID, NONEQUILIBRIUM FLOW BEHIND BOW AND NORMAL SHOCK WAVES. PART I: GENERAL ANALYSIS AND NUMERICAL EXAMPLES
Paul V. Marrone May 1963 113 p refs
(Contract DA-30-069-ORD-3443; ARPA Order-253-62)
(CAL-QM-1626-A-12(1); AI-408766)

The investigation of the relaxation processes of multicomponent reacting gases behind normal and bow shock waves is presented. The report provides a detailed discussion of the nonequilibrium shock wave programs. The purpose of the report is to give a detailed analysis of the problem and to present numerical examples. Discussed is the thermodynamic and chemical kinetic models for a complex reacting mixture of ideal gases. The inverse method, used to compute the nonequilibrium flow around the nose of a blunt, hypersonic vehicle, is presented in detail. The effect of vibrational nonequilibrium and vibration-dissociation coupling on the chemical relaxation zone is shown for both normal and bow shock waves. Several numerical examples are given to illustrate the nonequilibrium shock layer flow around a blunt-nosed, hypersonic vehicle. Author

N64-22535 Hydronautics, Inc., Laurel, Md.
DOWNWASH DUE TO A FULLY CAVITATED HYDROFOIL BENEATH A FREE SURFACE
B.Yim Jul. 1963 49 p
(Contract NObs-78396)
(TR-001-12; AD-601099)

Since the point where the downwash is calculated is far from the cavitated hydrofoil, the effect of the detailed shape of the hydrofoil is small. Therefore, for the sake of simplicity, the cavitated hydrofoil under the free surface is assumed to have the form of a simple model made of a vortex line and a uniform source plus a line sink. Due to the linearity of the potential, the downwash due to the vortex and due to the source may be dealt with separately. For the downwash due to vortex, the recommended expression by Kaplan, Breslin, and Jacobs (1960) is used. For the downwash due to the source distribution, the problems are formulated for the cases of both two and three dimensions. Numerical computations made on the IBM-1620 digital computer for the downwash at various downstream and spanwise positions at the same depth as the hydrofoil, and covering a large range of Froude numbers, are given in the form of curves. Author

N64-22536 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
REYNOLDS STRESS NEAR A FLEXIBLE SURFACE RESPONDING TO UNSTEADY AIR FLOW
J. E. Ffowcs Williams 3 Jun. 1964 26 p refs
(Contract Nonr- 3944(00))
(Rept.-1138; AD-601401)

Surface response to pressure perturbations induced by fluctuating airflow is known to influence the stability of the flow and, at higher Reynolds number, its turbulent state. Although energy arguments can only be applied to the stability problem with extreme caution, they play a less subtle role in turbulence theory. Such arguments center on the transfer of energy from the mean motion to the unsteady field, a transfer made possible by the Reynolds stresses. This paper studies the way in which Reynolds stresses near the flow boundary are influenced by surface response. The technique of analysis is based on that developed by Lin (1954) to study the Reynolds stresses induced by viscous action in the vicinity of the surface. The technique is generalized to allow for a random surface motion, such as might be induced by turbulent flow, but the analysis is restricted to a two-dimensional surface profile. The most interesting outcome of the analysis is that the Reynolds stress assumes a negative sense close to the surface whenever the phase speed of the perturbation exceeds the speed of free surface waves. The layer of fluid close to the mean position of the surface may then tend to starve the turbulent eddies of their energy supply and may lead to a reduction in the turbulence level. Author

N64-22543 Naval Weapons Lab., Dahlgren, Va. Computation and Analysis Lab.
ROTATING FLOWS OVER A ROTATING DISK
Ernst W. Schwiderski and Hans J. Lugt Apr. 1964 48 p refs
(NWL-1913; AD-601195)

Local boundary-layer approximations of first order are computed for axisymmetric motions that rotate over a rotating disk in the same and opposite directions. The secondary motions, produced by the friction forces at the rotating disk, are essentially of pure stagnation type, distorted stagnation type, cell type, and pure wake type. Critical Reynolds numbers of steady laminar motions, attached to the disk, are computed. They reveal stability properties of rotating flows, important in practical applications. Author

N64-22544 Harvard U., Cambridge, Mass. Acoustics Research Lab.
THRESHOLDS OF ACOUSTIC CAVITATION
James E. Barger Apr. 1964 181 p refs
(Contract Nonr-1866(24))
(TM-57; AD-600839)

Cavitation thresholds in water have been measured as a function of frequency, dissolved gas, ambient pressure, and suspended particle size. The threshold data can be divided into three regions. In region A, defined by $f < 200$ kc, acoustic pressure $P_a < 3$ bars, and air saturation pressure $P_s > 600$ mm Hg, small air bubbles grow by rectified diffusion and stabilize at the pressure nodes. In region B, defined by $f < 200$ kc, $P_a > 3$ bars, and $P_s < 500$ mm Hg, transient cavities are formed that can be detected visually and aurally. In region C, $f > 200$ kc, $P_a > 3$ bars, for any value of P_s, transient cavities are formed, but their presence can be detected only acoustically. Experiments on cavitation at pressures larger than the threshold indicate that only a finite number of cavitation events can be produced in a given sample of water when it is isolated from contamination by airborne motes. In this way water can be "strengthened" by a factor of at least 8 by repeated cavitation. Author

N64-22552 Brown U., Providence, R.I. Applied Mathematics Div.
ON THE STRUCTURE OF WAKES AND WAVES. I. DEVELOPMENT OF INITIAL DISTURBANCES IN A NAVIER-STOKES FLUID Technical Report No. 56
Lawrence Sirovich Apr. 1964 31 p refs
(Contract Nonr-562(07))
(Rept.-562(07)56; AD-600591)

The solution to the initial value problem for the linearized Navier–Stokes equations is described. For times that are large, as compared with the time between molecular collisions in the gas, an explicit form of the asymptotic solution is given. As a consequence it is shown that inviscid theory only appears as a nonuniform limit and that for very long times dissipation dominates the solution. For times that are large, as compared with the time necessary for a sound wave to traverse the extent of the initial disturbance, an extremely simple asymptotic solution is obtained. This depends on

only the gross properties of the initial disturbance. An argument is given showing that only the leading term in the Navier–Stokes asymptotic expansion is accurate. Author

N64-22558 Aerospace Corp., El Segundo, Calif.
STRUCTURE OF RADIATION-RESISTED SHOCK WAVES WITH VIBRATIONAL NONEQUILIBRIUM
George Emanuel 15 May 1964 45 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-78; TDR-269(4230-20)-9; AD-601399)

The continuum equations of gasdynamics are used to study the effect of thermal radiation and vibrational nonequilibrium on the structure of a shock wave. Emphasis is on a description of the gasdynamic phenomena involved, rather than on numerical results. For example, a Mollier diagram interpretation, useful for understanding radiation-resisted shockwaves, is given. The principal results stem from an analysis of the singular-point structure far upstream and far downstream in the flow. This analysis indicates in a heuristic fashion that a unique solution exists. It also shows that two parameters, a Mach number and the ratio of a radiation length to a relaxation length, primarily govern the qualitative behavior of the flow. Author

N64-22605 ARO, Inc., Arnold Air Force Station, Tenn.
SPECIFIC HEAT AND SPEED OF SOUND DATA FOR IMPERFECT NITROGEN 1. T = 2.000 TO 15,000° K
Clark H. Lewis and Charles A. Neel Arnold Eng. Develop. Center, Jun. 1964 156 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-113; AD-601241)

Specific heat and speed of sound data were computed for imperfect nitrogen. The thermodynamic data included the effects of two-body intermolecular forces, and the results were obtained by numerical interpolation and differentiation of the recent data of Hilsenrath and Klein. Results are given for the ranges T = 2,000(100)15,000° K and log ρ = −6.8(0.2)2.2. Comparisons with previous perfect gas calculations showed small effects on the specific heat data at all pressures considered; however, at pressures near 1,000 atm, the effects were larger on the speed of sound data. Author

N64-22606 ARO, Inc., Arnold Air Force Station, Tenn.
SPECIFIC HEAT AND SPEED OF SOUND DATA FOR IMPERFECT NITROGEN—11. T = 100 TO 2200° K
Clark H. Lewis and Charles A. Neel Arnold Eng. Develop. Center, Jun. 1964 51 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-114; AD-601205)

The final data presented were obtained by numerical interpolation and differentiation of the thermodynamic data taken from several sources. The data are presented in three tables: (1) specific heat and speed-of-sound data for imperfect nitrogen in the temperature range from 100° to 1,200° K; (2) specific heat and speed-of-sound data for imperfect nitrogen in the temperature range from 1,000° to 2,200° K; (3) thermodynamic properties of imperfect nitrogen, including second virial coefficient effects. An imperfect gas is one that obeys the equation p = ZρRT and is subject to intermolecular forces. P.V.E.

N64-22608 Air Force Cambridge Research Labs., Bedford, Mass. Meteorology Lab.
OPERATIONAL PREDICTION OF DIFFUSION DOWNWIND FROM LINE SOURCES
William P. Elliott and Morton L. Barad Mar. 1964 63 p refs *Its* AF Surveys in Geophys. No. 156
(AFCRL-64-163; AD-441351)

Graphs of expected dosage from an infinite line source are presented for various wind speeds, heights of release, and stability conditions. The graphs are based on Sutton's diffusion equation with parameters derived from Project Prairie Grass data by Haugen, Barad, and Antanaitis. A method of estimating the range of validity of these equations for a line source of finite length is also presented. Author

N64-22616 RAND Corp., Santa Monica, Calif.
AIR RADIATION FROM NONEQUILIBRIUM WAKES OF BLUNT HYPERSONIC REENTRY VEHICLES
R. O. Hundley Jun. 1964 68 p refs
(ARPA Order 189-61; ARPA SD-79)
(RM-4071-ARPA; AD-441139)

The aim of this memorandum is to describe the aerodynamic and chemical processes affecting radiation in the nonequilibrium regime, to discuss the connection between the flow-field properties and the radiation, and to describe the characteristics of the radiation that is emitted. Numerical estimates of the intensity of the nonequilibrium radiation were made for various values of the flight parameters. The only case considered was that of blunt bodies, where the nonequilibrium effects were the most pronounced, and only radiation that was in the UV visible and in the IR was considered, since this spectral region contained the bulk of the radiant energy. N.E.A.

N64-22631 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATING A THREE-DIMENSIONAL LAMINARY BOUNDARY LAYER ON SPREADING LINES
V. S. Avduyevskiy 15 Feb. 1963 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. i Mashinostr. (Moscow), no. 1, 1962 p 32–41
(FTD-TT-62-1723/1+2; AD-401590)

The case of a flow in the environment of spreading lines of a cone under an angle-of-attack, of an infinite cylinder with slipping and forward critical point is investigated. For this case, equations of a three-dimensional compressible boundary layer were transformed into a system of ordinary differential equations. A method for solving the equations, based on the use of integral ratios and a special form of approximating functions, was introduced. Formulas and numerical solutions for the calculation of heat exchange, friction, and boundary-layer characteristics were obtained. N.E.A.

N64-22633 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CALCULATION OF A TRANSVERSE CROSS SECTION BY A METHOD OF CHARACTERISTICS
G. A. Sokolovskiy 1 Mar. 1963 14 p refs Transl. into ENGLISH from Energomashinostr., (Moscow), no. 12, 1961 p 22-24
(FTD-TT-62-1739/1+2+4; AD-401588)

Consideration is given to a method of constructing a flow spectrum in a transverse cross section by calculating the curvature of the back of the airfoil and of the root compression shock. Calculations for TN-2-II airfoils are compared with experimental results. Author

N64-22636 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AN APPROXIMATE METHOD FOR CALCULATING AXISYMMETRICAL SUPERSONIC ISENTROPIC GAS FLOWS WITH LITTLE DIVERGENCE OF THE FLOW

V. G. Dulov 23 Jan. 1963 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Ser. Aviats. Tekhn. (USSR), no. 2, 1962 p 8–14
(FTD-TT-62-1802/1+2+4; AD-299676)

A method for calculating axisymmetrical isentropic flows is proposed. Only partial linearization is performed while the main characteristics of nonlinear problems are retained. The applicability of the method is limited by the assumption of isentropicity of the flow and the assumption of sufficient smallness of the divergence angles of the flow. An approximate estimation of the accuracy is made by comparing the simplest exact solutions with approximate calculations made under the same boundary conditions. P.V.E.

N64-22663 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FLOW WITH FRICTION AND HEAT EXCHANGE IN A CONICAL NOZZLE
D. V. Fedoseyev and S. V. Shteyman 31 Dec. 1963 7 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh., Akad. Nauk Belorusskoi SSR (Minsk), v. 6, no. 8, 1963 p 41–44
(FTD-TT-63-1040/1+2; AD-430337)

Flow in a supersonic conical cooled nozzle with friction is discussed. The parameters of the flow in each section are found, as well as the impulse and the total-pressure recover coefficient. Author

N64-22707 Naval Weapons Lab., Dahlgren, Va. Computation and Analysis Lab.
AXISYMMETRIC VISCOUS FLUID MOTIONS AROUND CONICAL SURFACES
E. W. Schwiderski, H. J. Lugt, and P. Ugincius May 1964 35 p refs
(NNL-1922; AD-600962)

The introduction of complex Navier–Stokes equations shows that steady axisymmetric motions of viscous incompressible fluids around conical surfaces can be expressed in terms of the corresponding general solution of the Stokes equations of slow motions. The latter integration is accomplished with the aid of slow-motion eigenfunctions with integral eigenvalues for infinite plates and semi-infinite needles and with generally complex eigenvalues for cones and conical corners. The eigenvalues and eigenmotions obtained resemble the corresponding eigenvalues and eigenmotions of the analogous flows past dihedral angles. In particular, the existence of critical and branching eigenvalues reveals that laminar flows past conical surfaces depend on the cone angle in a nonanalytic manner. The investigations include a note on diffusor and jet flows. Author

N64-22713 Rensselaer Polytechnic Inst., Troy, N.Y.
APPLICATION OF THE GALERKIN METHOD TO SELF-ADJOINT, NON-POSITIVE DEFINITE EIGENVALUE PROBLEMS IN HYDRODYNAMIC STABILITY
Sherman Tsao 25 May 1964 29 p refs
(Contract Nonr-591(08))
(RPI MATH 66; AD-601107)

The method of Galerkin for obtaining approximate eigenvalues is applied to a class of self-adjoint but not positive definite (M-definite) eigenvalue problems. The present investigation shows that the positive and negative approximate eigenvalues obtained from the Galerkin method are respectively the upper and lower bounds of the corresponding exact eigenvalues. The sequence of approximate eigenvalues obtained using successively more expansion functions converged monotonically to the exact eigenvalues. Finally a method for predetermining the signs of the approximate eigenvalues is given. As numerical examples of the theory, two M-definite eigenvalue problems arising from inviscid stability analyses of flows between concentric cylindrical surfaces are considered. Author

12 GEOPHYSICS

Includes auroral phenomena; upper atmosphere studies; oceanography; cartography; geodesy; and geomagnetism. *For Van Allen belts see*: 28 Space Radiation. *For related information see*: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N64-21513 International Astronomical Union, Hailsham (Gt. Brit.)
REPORT OF THE WORKING GROUP ON THE SYSTEM OF ASTRONOMICAL CONSTANTS TO THE EXECUTIVE COMMITTEE OF THE INTERNATIONAL ASTRONOMICAL UNION
W. Fricke, et al [1964] 11 p refs

Reported are principal recommendations on the system of astronomical constants. A reference list of the constants of the system and a set of explanatory notes are presented. The term "primary constant," rather than "fundamental constant," has been used since the latter has a connotation in astronomical usage that is inappropriate to the manner of selection of the primary constants. The manner in which this system should be introduced into the national and international ephemerides is also discussed. N.E.A.

N64-21514 Kiruna Geophysical Observatory (Sweden)
MAGNETOMETER, PHOTOMETER, AND EARTH CURRENT OBSERVATIONS AT KIRUNA Final Report
Georg Gustafsson and Alv Egeland 15 Feb. 1964 75 p refs
(Contract AF 61(052)-688)
(AFCRL-64-245; AD-434778)

The magnetic data have been represented by the K-indices, which give the range of the magnetic variation during 3-hour periods. The auroral activity has been measured by a photometer scanning along the geographic meridian. The intensity of the green auroral line has been measured, and an auroral index related to the intensity of λ 5577 A line has been included. Equipment for the measurement of the earth current potentials has been installed at the observatory. The potential variations of the east–west, and north–south components have been measured. It has been found that the north–south component is 3.5 times stronger than the east–west component. The data of the earth current variations (north–south component) have been represented by the range of variation in mv/km over 3-hr intervals. Author

N64-21516 Naval Research Lab., Washington, D.C. E. O. Hurlburt Center for Space Research
IONOSPHERIC CHEMISTRY
J. C. Holmes, C. Y. Johnson, and J. M. Young [1964] 31 p refs Presented at the COSPAR Meeting in Florence, May 1964

Day and night observations were made of the positive ion composition of the ionosphere between 120 and 230 km. Certain chemical reactions were found to be consistent with the experimental observations. Mechanisms for the active production of the night E region are shown to be inconsistent with the measurements. An analysis of the day-to-night decay in the E region suggests that the values of the dissociative recombination coefficients for O_2^+ and NO^+ increase with increasing temperature. It is proposed that simple decay via dissociative

recombination may explain the maintenance of the night E region. Author

N64-21520 Kiruna Geophysical Observatory, (Sweden)
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 63/4, OCTOBER–DECEMBER 1963
[1964] 65 p refs
(Partially supported by AF-EOAR)

Current geophysical data related to polar upper atmosphere conditions are presented in summary and tabular form. Among the measurements made were those of solar particle radiation effect on the geomagnetic field; ionospheric absorption; oblique very-high-frequency auroral reflections; very-low-frequency radio wave propagations; and earth currents. A.W.

N64-21560 Chicago U., Ill. Labs. for Applied Sciences
CALCULATION OF THE INTENSITY OF THE LIGHT SCATTERED IN THE ATMOSPHERE IN THE WAVELENGTH REGION 2300A TO 3100A WITH ABSORPTION BY OXYGEN AND OZONE CONSIDERED
Eugene L. Hubbard Sep. 1963 132 p refs
(ARPA SD-71)
(LAS-TR-199-48; AD-424522)

The diffuse field approach has been used to calculate the intensity of the scattered light in the earth's atmosphere. Emphasis was placed on the ultraviolet region of the solar spectrum, with the absorption of ozone and oxygen included where appropriate. Curves of optical depth, incomplete gamma function, method of averaging, computer program, and general results are discussed. A.W.

N64-21613 Joint Publications Research Service, Washington, D.C.
MEASURING THE NATURAL ELECTRICAL FIELD AT SEA
Ye. A. Domanitskiy and M. G. Strunskiy 9 Jun. 1964 26 p refs Transl. into ENGLISH from Okeanologiya (Moscow), no. 2, Feb. 1964 p 325–339
(JPRS-24989; OTS-64-31437) OTS: $0.75

The object of the study was the variation of the natural electric field at sea, with a period varying from several minutes to fractions of a second. Continuous recordings of the variations of the electric field were made in different conditions and regions of the sea, at depths of from 1 to 100 m. The duration of the recording was from 10 to 70 min, with tape-advance rates of the recorders varying from 0.8 to 2.7 mm/sec. Specifically discussed were principles of measurements, the apparatus used in the measurements, the methodology of measurements, processing of measurements, and the principal results of the measurements. N.E.A.

N64-21629 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STUDY OF THE MAGNETIC FIELD IN OUTER SPACE
Sh. Sh. Dolginov and N. V. Pushkov *In its* Cosmic Res. 29 Oct. 1963 p 89–171 refs (See N64-21626 15-01)

This article reviews experimental data on the magnetic field of the earth, the moon, and interplanetary space obtained with the aid of earth satellites and space rockets in the Soviet Union and the U.S.A. Results are compared of measurements carried out in the immediate vicinity of the earth, in the outer radiation belt, and on the boundary of the geomagnetic field on magnetically quiet and magnetically disturbed days on the diurnal and nocturnal sides of the earth. Author

N64-21630 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROBLEMS OF INTERPRETING THE RESULTS OF MEASUREMENTS OF OUTGOING RADIATION BY MEANS OF METEOROLOGICAL SATELLITES
K. Ya. Kondrat'yev *In its* Cosmic Res. 29 Oct. 1963 p 172–199 refs (See N64-21626 15-01)

On the basis of an analysis of the results published in Soviet and other literature, the basic problems of interpreting the results of measurements of outgoing radiation obtained by means of meteorological satellites are discussed. Author

N64-21631 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STRUCTURAL CHARACTERISTICS OF THE RADIATION FIELD OF THE EARTH AS A PLANET
Ye. P. Borisenkov, Yu. P. Doronin, and K. Ya. Kondrat'yev *In its* Cosmic Res. 29 Oct. 1963 p 200–222 refs (See N64-21626 15-01)

Results are given of a statistical investigation of fields of outgoing radiation according to measurement data from Tiros II. Structural and correlation functions are constructed for each of the 52 orbits. A comparison is made between the radiation fields and the meteorological parameters of the atmosphere. All of the calculations were done on the Ural-2 electronic computer. Author

N64-21632 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATIONS OF THE UPPER ATMOSPHERE WITH SATELLITES COSMOS-3 AND COSMOS-5. 1: INSTRUMENTATION
Yu. I. Gal'perin and V. I. Krasovskiy *In its* Cosmic Res. 29 Oct. 1963 p 223–234 refs (See N64-21626 15-01)

Instruments carried on satellites Cosmos-III and Cosmos-V are described. Instrumentation included two traps for fast charged particles, five fluorescent-screen electron indicators, and a Geiger counter. The traps permitted recording of positive ion currents in the ranges from 3×10^5 to 5×10^6 ions/cm^2 sec steradian and from 3×10^5 to 3×10^8 ions/cm^2 sec steradian, respectively. The fluorescent screen indicators, covered with 0.4, 0.6, and 1.1 mg/cm^2 aluminum foil, permitted recording electrons over a wide range of energies starting from 40 ev. Signals from electrons with energies lower than 50 Kev were modulated with a step-type accelerating voltage. This modulation made it possible to analyze low-energy electrons. Additional information concerning the energies of electrons resulted from comparison of data obtained from indicators using foil of different thickness as well as from the degree of modulation of the signal as the satellite rotated in an anisotropic radiation field. The threshold of detection for electrons with energies of 40 ev and 7 Kev was 2×10^8 and 2×10^6 electrons/cm^2 sec steradian, respectively. The Geiger counter, shielded with 3.4 g/cm^2 Pb + 0.8 g/cm^2 Al had a geometric factor of 25 cm^2 × steradian and was able to register directly protons with energies exceeding 50 Mev and electrons with energies exceeding 10 Mev. The detecting efficiency for bremsstrahlung of electrons of lower energy dropped sharply, and the counter was practically insensitive to electrons with energies less than 400 Kev. Author

N64-21635 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATIONS OF THE UPPER ATMOSPHERE WITH SATELLITES COSMOS-3 AND COSMOS-5. 4: DENSITY OF THE UPPER ATMOSPHERE AT HEIGHTS OF 200–230 KM

M. Ya. Marov *In its* Cosmic Res. 29 Oct. 1963 p 256–261 refs (See N64-21626 15-01)

Data are given on the deceleration of Cosmos-III and Cosmos-V, and estimates are made of the atmospheric density in the region of their perigees. Author

N64-21636 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE DISTRIBUTION OF HELIUM, NITROGEN, AND ARGON IN THE EARTH'S ATMOSPHERE UP TO A HEIGHT OF 430 KM

A. A. Pokhunkov *In its* Cosmic Res. 29 Oct. 1963 p 262–278 refs (See N64-21626 15-01)

This article examines the results of experimental investigations of the neutral composition of the atmosphere by a radiofrequency mass spectrometer on a geophysical rocket. Data are cited concerning the distribution of temperature in the atmosphere at heights of 130 to 430 km and data on the measurements of the absolute concentrations of molecular nitrogen. A gravitational separation of the gases Ar and N_2 was detected. Data are given on the upper boundary of the concentration of neutral helium and the distribution of helium ions at heights above 370 km. Author

N64-21637 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MEASUREMENTS OF THE ATMOSPHERIC DENSITY BY AN INSTRUMENTED NONORIENTED SATELLITE

M. N. Izakov *In its* Cosmic Res. 29 Oct. 1963 p 279–284 refs (See N64-21626 15-01)

This article suggests a method of measuring the atmospheric density by 6 manometers or mass spectrometers installed on a satellite, without additional instruments for determining orientation. Author

N64-21638 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MEASUREMENTS OF ATMOSPHERIC TEMPERATURE BY AN INSTRUMENTED SATELLITE

M. N. Izakov *In its* Cosmic Res. 29 Oct. 1963 p 285–301 refs (See N64-21626 15-01)

The accuracy of determining atmospheric temperature by the readings of two mass spectrometers or manometers installed on a satellite is evaluated. Conclusions are made concerning the requirements for orientation of the satellite and the expedient arrangement of the instruments. Author

N64-21661 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HANDBOOK ON THE HIGH-ALTITUDE VERTICAL-HORIZONTAL SOUNDING OF THE ATMOSPHERE IN THE IL-28 AIRCRAFT

20 Mar. 1964 194 p ref Transl. into ENGLISH from "Rukovodstvo po Vysotnomu Vertikal'no-Gorizontal'nomu Zondirovaniyu Atmosfery na Samolete IL-28" Moscow, Gidrometeorol. Izd., 1962 p 1–147

(FTD-TT-63-619/1+2; AD-600134)

This handbook includes the following: (1) how to carry out vertical and horizontal sounding of the atmosphere in an IL-28 aircraft; (2) preflight servicing of the assembly of the K4-51 optical recorder and processing of its recording tape in the aircraft; (3) technical servicing and periodic calibration of K4-51 optical recorders; and (4) operation of the equipment of the stern cabin. I.v.L.

N64-21716 Ohio State U., Research Foundation, Columbus

ON THE ACCURACY OF GEOID HEIGHTS AND DEFLECTIONS OF THE VERTICAL Scientific Report No. 5

E. Groten and H. Moritz Mar. 1964 42 p refs

(Contract AF 19(628)-2771)

(Rept.-38; AFCRL-64-319; AD-600671)

The accuracy of the geoid undulations and the deflections of the vertical, obtainable by means of different idealized gravity nets, is investigated. The following cases are assumed: one gravity station or one gravity profile in every 1° × 1°, 2° × 2°, 5° × 5°, and 10° × 10° blocks. Author

N64-21721 Ionosphären-Institut Breisach (W. Germany)

RESEARCH ON IONOSPHERIC STRUCTURE AND MOTION Technical Report

E. Harnischmacher 15 Nov. 1963 175 p refs

(Contract AF 61(052)-81)

(IIB-6; AFCRL-64-76; AD-600897)

Individual fadings observed with six antennas are reduced for different combinations of three of them. The differences between drift vectors so found are statistically analyzed. The normal case is not a plane but a curved front (radius down to 100 m). A descriptive interpretation is given by outgoing and ingoing curved fronts (sources and sinks). When a prevailing drift is present, the basic form of the extremal lines is elliptical. Statistics show an average axis ratio 2:1 with more sinks than sources. Five years of dense observations prove solar and lunar tides to be rather different for low and high declination. An automatic drift-measuring apparatus based on a cross-correlation technique is described. Author

N64-21728 Joint Publications Research Service, Washington, D.C.

RESULTS OF DIRECT DETERMINATION OF THE INTENSITY OF DEEP TURBULENT EXCHANGE IN THE ATLANTIC OCEAN

A. G. Kolesnikov, N. A. Panteleyev, and V. D. Pisarev 27 May 1964 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. CLV, No. 4, 1 Apr. 1964 p 788–791

(JPRS-24788; OTS-64-31345) OTS: $0.50

The measurement circuit of the deep-water autonomous turbulence meter is switched on by an automatic control unit in accordance with a prescribed program. Current is received from small storage and plate batteries. Measurements of current-velocity fluctuations are made by a platinum thermohydrometer with indirect heating; temperature fluctuations are measured by using the same sensor without heating. Values measured are recorded on 35-mm color film having four different colors to facilitate the interpretation of fluctuation curves. A.W.

N64-21756 International Geophysical Year World Data Center A, Washington, D.C.

TWELFTH 6-MONTHLY CATALOGUE OF DATA IN IGY WORLD DATA CENTER A, 1 JANUARY–30 JUNE 1963

Washington, NAS-NRC, Nov. 1963 227 p refs

(IGY-Gen. Rept.-20)

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11. METEOROLOGY AND NUCLEAR RADIATION p 209–217 refs (See N64-21766 15-21)

N64-21809 Navy Electronics Lab., San Diego, Calif.
MEASUREMENTS OF THERMAL STRUCTURE BETWEEN SOUTHERN CALIFORNIA AND HAWAII WITH THE THERMISTOR CHAIN Research and Development Report, Aug. 1961–Aug. 1963
E. C. La Fond and A. T. Moore 7 Feb. 1964 48 p refs
(NEL-1210; AD-435854)

A study was made of the thermal structure of the upper 800 feet of the sea by towing the NEL thermistor chain in deep water between San Diego, California, and Honolulu, Hawaii. The median vertical (slope) in temperature sections proved to be 0° 16′ and the 70-percentile (slope), 0° 30′, and the significant high-frequency peaks in the power spectrum of isotherm depths are more numerous in the central part of the section between Hawaii and California. Author

N64-21828 RAND Corp., Santa Monica, Calif.
ENERGY DEPOSITION IN THE ATMOSPHERE FROM HIGH ALTITUDE GAMMA RAY SOURCES
J. I. Marcum Nov. 1963 28 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3594-PR; AD-431867)

This report gives results for the deposition of energy in the atmosphere from two high altitude sources of gamma rays. The solutions were obtained by use of the Monte Carlo gamma-ray transport code and are presented in such a way that they can be easily compared to results previously obtained for infinite homogeneous media. In two particular cases, the deposition of energy from high altitude sources of gamma rays over a large volume of space does not differ from the equivalent problem with a uniform atmosphere by more than a factor of 2. Author

N64-21834 Rice U., Houston, Tex.
THE DISSIPATION OF HYDROMAGNETIC WAVE ENERGY IN THE IONOSPHERE
A. J. Dessler Apr. 1964 9 p refs Presented at the 5th Intern. Space Science Symp., Florence, May 1964
(Grant NSF GP-2228)

The basic concepts of ionospheric heating by hydromagnetic waves are reviewed. The theoretical aspects are well understood and were treated at length in the literature. Experimental data on the hydromagnetic wave power spectrum are not available. Therefore, the possible geophysical importance of this mechanism cannot be evaluated quantitatively. It is tentatively concluded that hydromagnetic heating may be important during geomagnetically active periods but not during quiet periods. Author

N64-21852 Deutscher Wetterdienst, Offenbach Am Main (W. Germany)
PROJECT CELL STRUCTURE OF THE ATMOSPHERE. ON THE BEHAVIOR OF THE DENSITY GRADIENTS IN THE UPPER STRATOSPHERE AND THE MESOSPHERE Scientific Report No. 2
Eva Soos and H. Faust Dec. 1963 21 p refs
(Contract DA-91-591-EUC-2847)
(AD-433767)

The vertical distribution of the air density and the variation of air density with season and latitude, all between altitudes of 30 and 85 km, were the subjects of this investigation. Considering separately the temporal and the meridional +variations of the air density, theoretical speculations were made with respect to the change of the sign of the horizontal density gradient and the formation of isopycnic layers in the stratosphere and the mesosphere. Empirical data of the air density, from all available density measurements for 30° and 60° N latitudes, were compiled for the extreme seasons, summer and winter, and their mean values were derived. The findings are well in accordance with those previously reported and with the theoretical speculations. Author

N64-21876* National Aeronautics and Space Administration, Washington, D.C.
AURORAE AND AIRGLOW
V. I. Krasovskiy, ed. May 1964 91 p refs Transl. into ENGLISH of "Polyarnyye Siyaniya i Svechniye Nochnogo Neba", IGY Program, Sect. 4, no. 9, Moscow, Izd. AN SSSR, 1962
(NASA-TT-F-202) OTS: $2.25

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2. VARIATIONS IN THE POPULATIONS OF THE VIBRATIONAL LEVELS OF HYDROXYL MOLECULES V. I. Yarin p 7–20 refs (See N64-21878 15-12)
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4. SEARCH FOR VARIATIONS OF THE H_α PROFILE Yu. I. Gal'perin and O. T. Yurchenko p 29–38 refs (See N64-21880 15-12)
5. BEHAVIOR OF CERTAIN EMISSIONS IN AURORAL RAYS F. K. Shuyskaya and V. G. Trunov p 39–41 refs (See N64-21881 15-12)
6. ON THE EMISSIONS OF MOLECULAR OXYGEN OBSERVED IN YAKUTSK V. I. Yarin p 42–57 refs (See N64-21882 15-12)
7. ROTATIONAL TEMPERATURE OF OH BANDS, BASED ON OBSERVATIONS MADE IN ASHKHABAD G. I. Salova p 58–60 refs (See N64-21883 15-12)
8. OH EMISSION AND THE ATMOSPHERIC BAND λ 8,645 A of the O_2 MOLECULE M. A. Berg and N. N. Shefov p 61–70 refs (See N64-21884 15-12)
9. THE EMISSION (NI) λ 5,200 A BASED ON OBSERVATIONS MADE IN YAKUTSK V. I. Yarin p 71–74 refs (See N64-21885 15-12)
10. THE TWILIGHT EMISSION OI λ 8,446 A N. N. Shefov p 75–80 refs (See N64-21886 15-12)
11. OBSERVATION OF A TWILIGHT BURST OF HELIUM EMISSION λ 10,830 A WITH A FABRY-PEROT STANDARD P. V. Shcheglov p 81–83 refs (See N64-21887 15-12)
12. CERTAIN FEATURES OF THE CONTINUUM IN TWILIGHT V. I. Yarin p 84–86 refs (See N64-21888 15-12)

N64-21877* National Aeronautics and Space Administration, Washington, D.C.
SEASONAL AND ANNUAL VARIATIONS IN THE INTENSITY OF THE NIGHT AIRGLOW IN ABASTUMANI
L. M. Fishkova *In its* Aurorae and Airglow May 1964 p 1–6 refs (See N64-21876 15-12) OTS: $2.25

The paper discusses seasonal and annual variations of the absolute intensities of OH bands and of emissions (OI) λ 5577, 6300 A, and Na λ 5893 A, and also of the rotational temperature of the OH bands in airglow obtained as the result of systematic electrophotometric and spectrographic observations in Abastumani from 1953 to 1960. Author

N64-21878* National Aeronautics and Space Administration, Washington, D.C.
VARIATIONS IN THE POPULATIONS OF THE VIBRATIONAL LEVELS OF HYDROXYL MOLECULES
V. I. Yarin *In its* Aurorae and Airglow May 1964 p 7–20 refs (See N64-21876 15-12) OTS: $2.25

According to the observations in Yakutsk, the variations of the relative population of hydroxyl molecules were discovered. There is a tendency toward an increase in the vibrational temperature with an increase in the rotational temperature of the OH bands. Author

N64-21879* National Aeronautics and Space Administration, Washington, D.C.
LATITUDINAL AND PLANETARY VARIATIONS OF THE HYDROXYL EMISSION
N. N. Shefov and V. I. Yarin *In its* Aurorae and Airglow May 1964 p 21–28 refs (See N64-21876 15-12) OTS: $2.25

The rotational temperature of the OH bands has a more distinctly expressed dependence on the geographical latitude than on the geomagnetic one. A comparison of data from Zvenigorod and Yakutsk indicates simultaneous variations of the rotational temperature of the OH bands. Author

N64-21880* National Aeronautics and Space Administration, Washington, D.C.
SEARCH FOR VARIATIONS OF THE H_α PROFILE
Yu. I. Gal'perin and O. T. Yurchenko *In its* Aurorae and Airglow May 1964 p 29–38 refs (See N64-21876 15-12) OTS: $2.25

The paper describes the method of reduction of the H_α line profiles obtained by the modern spectrograph SP-47 with moderate dispersion and resolving ability. Considerable variations of the H_α line profile have not been detected so far. Author

N64-21881* National Aeronautics and Space Administration, Washington, D.C.
BEHAVIOR OF CERTAIN EMISSIONS IN AURORAL RAYS
P. K. Shuyskaya and V. G. Trunov *In its* Aurorae and Airglow May 1964 p 39–41 refs (See N64-21876 15-12) OTS: $2.25

The brightness distribution of ray emissions during the forceful aurora of March 2–3, 1958, is examined in this paper. The diffraction spectrograph SP-47 (relative aperture of the camera, 1:1; dispersion, 200 A/mm; grating, 600 lines/mm; slit height, 20 mm; slit width, 0.45 mm) was used. A band of the firmament 18° high was projected on the slit of this spectrograph. The slit width corresponded to approximately 24′ in angular measure on the firmament. The projecting objective was the PO-111 (f = 65 mm; relative aperture, 1:1.4). The spectrograph could be aimed at any point of the firmament, and could be rotated about the optic axis of the collimator. The effective spectral range was λ 5,300 to 6,600 A. Preexposed D_n-type film was used in taking the photographs. Author

N64-21882* National Aeronautics and Space Administration, Washington, D.C.
ON THE EMISSIONS OF MOLECULAR OXYGEN OBSERVED IN YAKUTSK
V. A. Yarin *In its* Aurorae and Airglow May 1964 p 42–57 refs (See N64-21876 15-12) OTS: $2.25

Absolute intensities and rotational temperatures of the Herzberg bands and of the atmospheric band (0.1) of the O_2 molecule are determined. The intensity of the Herzberg band is compared with the intensity of the OH, Na, and (OI) λ 6,364 A emissions. Author

N64-21883* National Aeronautics and Space Administration, Washington, D.C.
ROTATIONAL TEMPERATURE OF OH BANDS, BASED ON OBSERVATIONS MADE IN ASHKHABAD
G. I. Salova *In its* Aurorae and Airglow May 1964 p 58–60 refs (See N64-21876 15-12) OTS: $2.25

At the end of September and beginning of October, in 1957 and 1958, a marked decrease was observed in the rotational temperature, which exceeds observational errors. In 1958, a slow rise of the temperature was seen toward the end of the year. Based on the 9.3 OH band, the mean temperature was 250° K ±10° K and 241° K ±15° K for 1957 and 1958, respectively, and the mean values for the 9.3 and 6.1 OH bands were 250° K ±10° K and 237° K ±18° K. This temperature is somewhat higher than that obtained in Abastumani, where the observations were performed during the summer when the rotational temperature of the OH bands is at a minimum. Author

N64-21884* National Aeronautics and Space Administration, Washington, D.C.
OH EMISSION AND THE ATMOSPHERIC BAND λ 8,645 Å OF THE O_2 MOLECULE
M. A. Berg and N. N. Shefov *In its* Aurorae and Airglow May 1964 p 61–70 refs (See N64-21876 15-12) OTS: $2.25

According to the observations in Zvenigorod, there is a dependence between the intensity of the (0.1)O_2 λ 8,645 A band and the rotational temperatures of O_2 and OH. This dependence is similar to the one observed in Yakutsk for the hydroxyl radiation. There is also a dependence for the emission of the OH molecules, which confirms earlier results. Author

N64-21885* National Aeronautics and Space Administration, Washington, D.C.
THE EMISSION (NI) λ 5,200 Å BASED ON OBSERVATIONS MADE IN YAKUTSK
V. I. Yarin *In its* Aurorae and Airglow May 1964 p 71–74 refs (See N64-21876 15-12) OTS: $2.25

Observations of the (NI) 5,200 A emission in the quiet magnetic field of the earth, and the diurnal variations of the emission intensity are described. Author

N64-21886* National Aeronautics and Space Administration, Washington, D.C.
THE TWILIGHT EMISSION OI λ 8,446 Å
N. N. Shefov *In its* Aurorae and Airglow May 1964 p 75–80 refs (See N64-21876 15-12) OTS: $2.25

The emission OI λ 8,446 A was discovered through observations during twilight in the summer of 1960. The intensity of this emission had no apparent connection with the characteristic phenomena of aurorae. Author

N64-21887* National Aeronautics and Space Administration, Washington, D.C.
OBSERVATION OF A TWILIGHT BURST OF HELIUM EMISSION λ 10,830 Å WITH A FABRY-PEROT STANDARD
P. V. Shcheglov *In its* Aurorae and Airglow May 1964 p 81–83 refs (See N64-21876 15-12) OTS: $2.25

The twilight enhancement of the helium emission λ 10,830 A in the absence of auroral display has been observed with a Fabry–Perot interferometer having a low resolving ability.
Author

N64-21888* National Aeronautics and Space Administration, Washington, D.C.
CERTAIN FEATURES OF THE CONTINUUM IN TWILIGHT
V. I. Yarin *In its* Aurorae and Airglow May 1964 p 84–86 refs (See N64-21876 15-12) OTS: $2.25

The paper describes observations made in Yakutsk on the continuous spectrum of the twilight-sky emission. The emission maximum in the λ 5,800 to 6,100 A region, and the intensification of the continuum in the λ 5,700 to 6,100 A region are discussed.
Author

N64-21889* National Aeronautics and Space Administration, Washington, D.C.
AURORAE AND AIRGLOW [POLYARNYYE SIYANIYA I SVECHENIYE NOCHNOGO NEBA]
V. I. Krasovskiy, ed. May 1964 96 p Transl. into ENGLISH from IGY Program, Sect. IV, no. 8, Moscow, Izd. AN SSSR 1962
(NASA-TT-F-201) OTS: $2.25

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3. THE WAVELENGTHS OF THE ROTATIONAL-VIBRATIONAL OH BANDS L. V. Mironova and N. N. Shefov p 9–16 refs (See N64-21892 15-12)

4. THE OBSERVATIONS OF THE AIRGLOW NEAR THE AURORAL ZONE N. V. Dzhordzhio p 17–19 refs (See N64-21893 15-12)

5. CORUSCATION REGULARITIES IN AURORAE N. V. Dzhordzhio p 20–24 refs (See N64-21894 15-12)

6. THE CONTINUUM EMISSION IN THE AIRGLOW AND IN THE AURORAE O. G. Taranova p 25–28 refs (See N64-21895 15-12)

7. THE DESCRIPTION OF AURORAE FROM THE OBSERVATIONS IN ZVENIGOROD A. V. Mironov p 29–37 refs (See N64-21896 15-12)

8. THE SPECTROSCOPIC OBSERVATIONS OF AURORAE AND AIRGLOW AT THE ANTARCTIC STATION VOSTOK V. S. Ignatov p 38–44 refs (See N64-21897 15-12)

9. THE SPECTROELECTROPHOTOMETRY OF HYDROGEN EMISSION IN AURORAE O. L. Vaysberg p 45–54 refs (See N64-21898 15-12)

10. THE SPECTROELECTROPHOTOMETRY OF N_2, N_2^+, OI AND NII EMISSIONS IN AURORAE O. L. Vaysberg p 55–64 refs (See N64-21899 15-12)

11. THE HELIUM EMISSION IN THE UPPER ATMOSPHERE N. N. Shefov p 65–91 refs (See N64-21900 15-12)

N64-21890* National Aeronautics and Space Administration, Washington, D.C.
THE HYDROXYL EMISSION IN THE AIRGLOW SPECTRUM FROM OBSERVATIONS IN ALMA-ATA
Z. V. Karyagina *In its* Aurorae and Airglow May 1964 p 1–5 refs (See N64-21889 15-12) OTS: $2.25

According to the observations in Alma-Ata, the absolute intensities and rotational temperatures of OH bands (6.1 and 9.3) are determined. The relation between the intensity of OH bands and the rotational temperature for T ≤250° K has not been detected.
Author

N64-21891* National Aeronautics and Space Administration, Washington, D.C.
THE INTENSITY OF OH BANDS AS A FUNCTION OF THE ROTATIONAL TEMPERATURE
V. I. Yarin *In its* Aurorae and Airglow May 1964 p 6–8 refs (See N64-21889 15-12) OTS: $2.25

The results of reduction of the OH-band spectrograms, obtained during 1960–1961, confirm earlier detected dependence of the intensity of OH band (9.3) on the rotational temperature. The OH bands (5.0) and (3.0) possess this dependence in a weaker form.
Author

N64-21892* National Aeronautics and Space Administration, Washington, D.C.
THE WAVELENGTHS OF THE ROTATIONAL-VIBRATIONAL OH BANDS
L. V. Mironova and N. N. Shefov *In its* Aurorae and Airglow May 1964 p 9–16 refs (See N64-21889 15-12) OTS: $2.25

This paper presents the measured wavelengths of the OH bands in the spectral region λ 5,200 to λ 12,500 A. The results of the wavelength measurements are given in tabulated form. The comparison of these data with the data of other investigators shows satisfactory agreement of the measured wavelengths.
N.E.A.

N64-21893* National Aeronautics and Space Administration, Washington, D.C.
THE OBSERVATIONS OF THE AIRGLOW NEAR THE AURORAL ZONE
N. V. Dzhordzhio *In its* Aurorae and Airglow May 1964 p 17–19 (See N64-21889 15-12) OTS: $2.25

Simultaneous spectrographic observations uncovered the presence of bands of the first negative system of the ionized nitrogen molecule $1NGN_2^+$. In the years of maximum solar activity a permanent additional emission apparently takes place in the auroral zone even during calm airglow in the zenith.
N.E.A.

N64-21894* National Aeronautics and Space Administration, Washington, D.C.
CORUSCATION REGULARITIES IN AURORAE
N. V. Dzhordzhio *In its* Aurorae and Airglow May 1964 p 20–24 refs (See N64-21889 15-12) OTS: $2.25

On the basis of observations at Loparskaya, the auroral pulsations were studied. The emission λ 3,914, λ 5,577, λ 6,545 A, and the continuum emission λ 4,861 A are produced synchronously. The changes of auroral coruscation frequencies coincide with the corresponding changes of the variations of earth currents.
Author

N64-21895* National Aeronautics and Space Administration, Washington, D.C.
THE CONTINUUM EMISSION IN THE AIRGLOW AND IN THE AURORAE
O. G. Taranova *In its* Aurorae and Airglow May 1964 p 25–28 refs (See N64-21889 15-12) OTS: $2.25

On the basis of the observations in Loparskaya the spectral distribution of the continuum in the airglow and auroral spectra is determined. The energy distribution in the continuum was determined in absolute units for the spectral region λ 5,600 to λ 6,900 A. The mean absolute intensity of the continuum during exposure was determined by simultaneous electrophotometric measurements in the λ 5,890 and λ 6,300 A spectral regions. N.E.A.

N64-21896* National Aeronautics and Space Administration, Washington, D.C.
THE DESCRIPTION OF AURORAE FROM THE OBSERVATIONS IN ZVENIGOROD
A. V. Mironov *In its* Aurorae and Airglow May 1964 p 29–37 refs (See N64-21889 15-12) OTS: $2.25

This paper presents descriptions of aurorae visually observed near Moscow between 1957 to 1959. A characteristic of the magnetic field is given for the nights with aurorae. A summary of the emissions, recorded during the aurorae, is compiled. Author

N64-21897* National Aeronautics and Space Administration, Washington, D.C.
THE SPECTROSCOPIC OBSERVATIONS OF AURORAE AND AIRGLOW AT THE ANTARCTIC STATION VOSTOK
V. S. Ignatov *In its* Aurorae and Airglow May 1964 p 38–44 refs (See N64-21889 15-12) OTS: $2.25

The observations were made in 1959 at the Antarctic station Vostok situated near the south geomagnetic pole. A description of the measuring apparatus and method of application are given. Characteristics of auroral emission are presented briefly, and some results of spectral observations are given in tabulated form. N.E.A.

N64-21898* National Aeronautics and Space Administration, Washington, D.C.
THE SPECTROELECTROPHOTOMETRY OF HYDROGEN EMISSION IN AURORAE
O. L. Vaysberg *In its* Aurorae and Airglow May 1964 p 45–54 refs (See N64-21889 15-12) OTS: $2.25

Hydrogen emissions are not connected with auroral forms. The region of the hydrogen luminescence forms a homogeneous band 150- to 1,000-km wide, stretched along the geomagnetic parallel. In the initial stage of the auroral display, this hydrogen field shifts to the south and returns only during the last stage of the display. Due to the Van Rhine effect, the hydrogen field, when shifting to the horizon, has the form of a homogeneous arc with a distinct lower edge and a gradual diminishing of brightness with altitude. The occurrences of bright hydrogen fields precede bright aurorae, and are also connected with magnetic storms. The variations of the H_β profile were not detected. Author

N64-21899* National Aeronautics and Space Administration, Washington, D.C.
THE SPECTROELECTROPHOTOMETRY OF N_2, N_2^+, OI AND NII EMISSIONS IN AURORAE
O. L. Vaysberg *In its* Aurorae and Airglow May 1964 p 55–64 refs (See N64-21889 15-12) OTS: $2.25

Main emissions in the region λ 3,100 to λ 9,500 A are compared. Good correlation is observed between the band systems of the N_2 and N_2^+ molecules and the green line. In weak aurorae the preferable excitation of the first positive system N_2 is noted. The growth of the λ 8,446 A line intensity is slower than that of the green line intensity. The Meinel system N_2^+, if compared with the other emissions, is 1.8 times less intense in the hydrogen fields than in the auroral forms. Author

N64-21900* National Aeronautics and Space Administration, Washington, D.C.
THE HELIUM EMISSION IN THE UPPER ATMOSPHERE
N. N. Shefov *In its* Aurorae and Airglow May 1964 p 65–91 refs (See N64-21889 15-12) OTS: $2.25

This paper describes the excitation mechanism of the helium emission λ 10,830 A in sunlit aurorae and in twilight without aurorae. Observations of the twilight emission λ 10,830 A were used to determine the helium content in the earth's atmosphere at altitudes of about 1,000 km. Author

N64-21919 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE DISTRIBUTION OF DISPERSED ELEMENTS THROUGHOUT THE COMPONENTS OF WATER BASINS
N. V. Timofeyev-Resovskiy 18 Jan. 1963 11 p refs Transl. into ENGLISH from Tr. Inst. Biol. (USSR), no. 12, 1960 p 189–193
(FTD-TT-62-1314/1+4; AD-297570)

Biogeocenology is the study of the energy balance and the chemical elements of the living and inert components within the limits of a biogeocenosis. Biogeocenological experiments were carried out in fresh-water basins. These experiments dealt with the effect of radiations and radiators on fresh-water organisms, the coefficient of accumulation of certain chemical elements of water solutions by various soils and forms of water organisms, the sorption and desorption of elements from water by soils and sediments, the distribution of dispersed elements throughout the inert and living components of water basins, and the degree of purification and deactivation of water passing through weakly flowing water. Also discussed is biogeochemistry, the specific role played by living organisms in the geochemistry of the biosphere. Its primary task is the study of the participation of living organisms in the energy processes of the biosphere—circulation, migration, and concentration of chemical elements; erosion processes; formation of soil, natural water, and sedimentary rock. I.v.L.

N64-21959 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF WATER PERMEABILITY OF FROZEN GROUND
V. D. Komarov 8 Jan. 1964 18 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 2, 1957 p 10–18
(FTD-TT-63-928/1+2; AD-430240)

Results of various investigations of the water permeability of frozen ground include the following: (1) Not all of the water is found in the solid state, and nearly always, some of it remains in the liquid form. Unfrozen water is found in an equilibrized state with external factors—temperature, pressure, concentration, and components of water-soluble salts. (2) One of the basic causes of the low water permeability of frozen soil is the conversion of water to ice in the open capillaries—seamed and beaded—held by the force of surface attraction. (3) The phenomenon of migration of moisture in the soil strengthens the role of the frozen seam-type and beaded water in lowering the water permeability of frozen soil, since it leads to an increase in the ice content of the separate layers of the soil profile. (4) A substantial role is played by the latent heat of

the phase transitions of the water involved, at negative temperatures, in lowering the water penetrability of frozen soil as a result of the freezing of thaw water in the soil pores. I.v.L.

N64-21965 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOME NEW RESULTS OF GEOPHYSICAL INVESTIGATIONS WITH THE AID OF THE SATELLITES KOSMOS 3 AND KOSMOS 5
V. I. Krasovskiy, Yu. I. Gal'perin et al 18 Nov. 1963 17 p refs Transl. into ENGLISH from Geomagnetism i Aeronomiya (Moscow), v. 3, no. 3, 1963 p 408–416
(FTD-TT-63-1019/1+2; AD-425415)

Results are given of corpulscular radiation measurements of the upper atmosphere that were made with the aid of the satellites Cosmos 3 and Cosmos 5. Particles of the following different energy groups were recorded: (1) protons with energy greater than 50 Mev or electrons with energy greater than 0.4 Mev; (2) electrons with energy ~100 Kev or electrons with energy of the order of 10 Kev. The spatial disposition of these groups is not uniform and changes at the time of magnetic disturbances. Lines were plotted for equal intensity at heights of about 650 km over the South Atlantic magnetic anomaly for both groups. Electrons with energy of about 10 Kev appear sporadically. The rapid slowing down of the satellite Cosmos 3 is noted. Author

N64-22011 Brazil. Comissao Nacional de Atividades Espaciais, Sao Paulo.
COMPUTATION OF GROUP VELOCITIES IN THE IONOSPHERE
J. L. R. Muzzio Mar. 1964 27 p refs
(LAFE-10)

Simple mathematical formulas for the calculation of group velocity, group path, and attenuation of electromagnetic waves in the ionosphere were developed by Millington (1938). The Millington expressions are adapted for the calculation of the group velocity of ordinary and extraordinary rays. The computations were performed on an IBM-1620 data-processing system. R.T.K.

N64-22014 Brazil. Comissao Nacional de Atividades Espaciais. Lab. de Fisica Espacial
IONOSPHERIC ELECTRON CONTENT MEASUREMENTS IN REGIONS OF LOW MAGNETIC DIP ANGLES AND THROUGH THE BRAZILIAN MAGNETIC ANOMALY
Fernando de Mendonca May 1964 25 p refs Presented at the COSPAR 5th Intern. Space Sci. Symp., Florence

Differential Doppler measurements made with harmonically related frequencies transmitted from satellites are utilized for calculation of the latitudinal and diurnal variations of the total electron content of the ionosphere. These preliminary measurements cover areas with subionospheric points from the vicinity of the magnetic equator to about −40° dip, and between longitudes of 35° and 60° W. Mainly two distinct phenomena are noticed in the ionosphere of this region: (1) A latitudinal maximum value of the total electron content develops at the magnetic equator at sunrise and moves way toward higher dip angles for the whole day, possible due in part to diffusion in the higher ionosphere along the magnetic field lines. (2) There is a marked increase in electron content in the region that geographically corresponds to the area of the Brazilian anomaly of the earth's magnetic field in the South Atlantic. This enhancement in electron content is attributable to ionization caused mostly by high-energy particles of the artificial belt, which have mirroring points in levels well into the ionosphere at the magnetic anomaly. Author

N64-22072* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
SPHEROIDAL FREE PERIODS OF THE EARTH OBSERVED AT EIGHT STATIONS AROUND THE WORLD
L. E. Alsop Repr. from Bull. Seismol. Soc. Am., v. 54, no. 2, Apr. 1964 p 755–776 refs Work Performed in Cooperation with Columbia U.
(Contract AF 19(604)-7376; Proj. Vela-Uniform)
(NASA-RP-197)

Spectral peaks corresponding to the spheroidal free periods of oscillation of the earth exist in the spectra of eight seismograms written at stations in different parts of the world shortly after the great Chilean earthquake of 22 May 1960. These data have been combined with those previously reported by various authors, to obtain a very precise phase velocity vs period curve for Rayleigh waves in the period range of 200 to 3,200 seconds. The observed spectral amplitudes lend some support to the assumption of a moving source, but they also indicate that the present theory is not adequate. The vertical motion is found to be symmetric with respect to reflections through the pole. Author

N64-22105 Bureau of Mines, Laramie, Wyo. Laramie Petroleum Research Center
OIL-SHALE TECHNOLOGY: A REVIEW
H. M. Thorne, K. E. Stanfield, G. U. Dinneen, and W. I. R. Murphy 1964 28 p refs
(BM-IC-8216)

Oil shale, a potential source of products presently obtained from petroleum, is found in many countries. The most extensive known deposits from the standpoint of potential shale oil in place are those in Brazil and the United States. Mining methods used for oil shale range from open-pit operations for shallow deposits to room-and-pillar and longwall techniques for deposits with thick overburdens. Oil shales from different sources vary greatly in the amounts and types or organic and inorganic constituents. By retorting, the organic material is converted to oil, gas, and coke. The largest percentages of oil are obtained from materials having the highest hydrogen content. Over 2,000 retorting systems were patented, but only a few have been used industrially, and no single process seems best for all types of shales or economic conditions. Shale oils have different characteristics, depending on the source rock and method of retorting. They contain large quantities of olefinic hydrocarbons and more oxygen, nitrogen, and sulfur derivatives of hydrocarbons than most petroleums. Consequently, petroleum refining methods usually must be modified for shale oil. This is particularly true in catalytic processing. Hydrogenation, even under mild conditions, improves shale-oil refinability. Several byproducts may be obtained from both the retorting and refining steps. Author

N64-22124 Michigan U., Ann Arbor Inst of Science and Technology
ACOUSTIC DETECTION OF HIGH-ALTITUDE TURBULENCE
John W. Wescott Mar. 1964 51 p refs
(Contract DA-20-018-ORD-22840)
(Rept.-3746-38-T; AD-434705)

Background noise at frequencies from 0.2 to 200 cps was monitored with free-floating, balloon-borne acoustic probes at altitudes of 55,000 to 73,000 ft. Spectrograms, signatures, cross correlations, and probability-density curves were obtained from the data. The noise has a spectrum with 6 db/octave negative slope, is acoustic and Gaussian, and is time steady for periods of several hours, although noise pressures from 0.03 to 1 dyne/cm^2 were measured on different days. These and other

results indicate that the noise comes from lower altitudes and is produced by an array of statistically independent radiators, such as turbulent eddies. A theory for the power spectrum of noise radiated by turbulence is cited, and the predicted spectrum is compared to the experimental results. Other possible sources of high-altitude acoustic noise are described. Descriptions and illustrations of the instruments used to acquire and process the experimental data are presented. Author

N64-22255 Weapons Research Establishment (Australia) Dept. of Supply
IONOSPHERIC DATA FOR APRIL 1963 FROM SALISBURY, SOUTH AUSTRALIA
Jan. 1964 26 p
(Ionospheric Data Bull. CPD-1963/4(S))

Hourly values of ionospheric data of the E- and F-layers of the atmosphere are given in tabular form. The ionosonde used is a modified Cossor portable ionospheric recorder, Model 7562C (Mk. II). R.T.K.

N64-22301 Uppsala U. (Sweden) Inst. of Physics
GEOPHYSICAL ASPECTS OF COSMIC RAYS Final Report
Arne Eld Sandström 27 Apr. 1964 25 p refs
(Contract AF 61(052)-614)
(AFCRL-64-403; AD-600894)

Diagrams are presented that show the phase shifts of the yearly mean diurnal variation. Histograms are given that demonstrate the main types of cosmic-ray storms (CRS) as recorded at stations above the latitude knee of the nucleon component. Particular areas of activity discussed include the following: (1) corrections for atmospheric effects; (2) diurnal variation of the nucleon and meson components; (3) semidiurnal variation; (4) single events; (5) note on modulation models; (6) studies of the recovery stages of CRS; (7) spectral variations during CRS; (8) anomalous daily variations during CRS; (9) mean daily variation and geomagnetic activity; and (10) direction of cosmic-ray activity. P.V.E.

N64-22325 Aerospace Corp., El Segundo, Calif.
A COMPARISON OF DIFFERENT DETERMINATIONS OF J_{nm}
N. W. Albright 6 Mar. 1964 16 p refs
(Contract AF 04(695)-269)
(SSD-TDR-63-167; TDR-269(4110)-1; AD-601021)

J_{nm}'s are coefficient of the expansion of the earth's gravitational potential in spherical harmonics. This report compiles a list of the different determinations of these coefficients in order to determine how much agreement there is between different investigators, and also to see how broad a coverage of the earth was contained in the satellite data that was used. Author

N64-22421* Illinois U., Urbana Engineering Experiment Station
BEACON SATELLITE STUDIES OF SMALL SCALE IONOSPHERIC INHOMOGENEITIES
J. P. Mc Clure and G. W. Swenson, Jr. May 1964 65 p refs
(Grant NSG-24-59)
(NASA-CR-56481) OTS: $6.60 ph

The height of the irregularities responsible for scintillation was measured by the cross-correlation method for 130 satellite passages. The irregularity height in the F-region was found to be fairly constant for about two-thirds of the passages examined, and to be more or less variable about one-third of the time. The average height gradient for individual cases where the irregularity height is not constant was near zero. Increases in irregularity height to the north and to the south occurred with approximately equal probability. Height gradients were seldom uniform for more than 50 to 100 km. The average height of all F-region irregularities increased to the north. The heights of the irregularities in the E-region below 130 km were constant and had no gradients, unlike the irregularities in the F-region. Sufficient data were obtained to determine the diurnal variation of the irregularity height distribution. A concise expression was obtained for the cross-correlation as a function of the thickness and average height of a uniform slab of irregularities, the size of the irregularities, and the receiver spacing. Author

N64-22455* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
FAST NEUTRONS IN THE EARTH'S ATMOSPHERE. 2. TIME VARIATIONS AT HIGH ALTITUDES
Robert C. Haymes Repr. from J. Geophys. Res., v. 69, no. 5, 1 Mar. 1964 p 853–859 refs
(Contract NAS7-100)
(NASA-CR-56298; JPL-TR-32-540)

A series of balloon flights launched at $\lambda = 41°$ N are analyzed. The balloons carried omnidirectional detectors sensitive to fast neutrons and (separately) γ rays to altitudes of about 125,000 feet for periods of up to 24 hours. The observed latitude dependence is in accordance with the theory of Lingenfelter. The observed day-to-night ratios of the fluxes were 1.01 ± 0.02 and 1.00 ± 0.01. An upper limit of 0.02 neutron/cm^2 sec for the solar flux at the earth can be determined if it is assumed that the solar spectrum is similar to the terrestrial spectrum. The explanation for the small fluctuations that were observed probably lies in a slight time variation of the intensity of the charged radiation incident on the top of the earth's atmosphere. No evidence has been found for γ rays (energies between 0.47 and 3.50 Mev) emanating from the sun or from the Crab Nebula. Author

N64-22459* Geological Survey, Menlo Park, Calif.
FLUID IMPACT CRATERS AND HYPERVELOCITY-HIGH VELOCITY IMPACT EXPERIMENTS IN METALS AND ROCKS
H. J. Moore, D. E. Gault, and R. W. Mac Cormack, (NASA Ames Research Center) Nov. 1962 29 p refs
(Sponsored by NASA)
(NASA-CR-56359) OTS: $2.60 ph

The impact phenomena of hypervelocity and high-velocity projectiles with rock and metal targets are being studied. The investigation deals with these comparisons: (1) fluid-impact craters produced by water drops impacting water; (2) hypervelocity and high-velocity impact craters produced by impact of steel, aluminum, and polyethylene projectiles with basalt; and (3) hypervelocity and high-velocity impact craters in metal. N.E.A.

N64-22467* Alaska U., College Geophysical Inst.
THE DYNAMICAL MORPHOLOGY OF THE AURORA POLARIS
Syun-Ichi Akasofu Oxford, N.Y., Pergamon [1964] 58 p refs
Repr. from Ann. Intern. Geophys. Year, v. 20, Pt. 3 p 311–364
(Grant NsG-201-62)

Simultaneous changes of auroral form, brightness, and motion over the whole polar region are studied, using IGY all-sky camera records from widely distributed stations in Eastern Siberia, Alaska, Canada, Northern U.S., and Greenland. During very quiet periods, and sometimes for brief intervals during magnetic storms, the aurora may consist of faint, diffuse, quiet arcs extending along the whole of the auroral zone that is in darkness. The onset of a polar magnetic substorm suddenly changes this

quiet state of the aurora, especially on the morning part of the auroral zone. The aurora becomes active all along the zone, but in different ways at different local times, that is, at different positions relative to the midnight meridian. The polar magnetic substorms and active auroral changes usually last for one to three hours. Great auroral displays consist of an intermittent succession of such active periods. Author

N64-22484 Kyoto U. (Japan) WDC C2 for Geomagnetism
CATALOGUE OF DATA IN THE WORLD DATA CENTER C2 FOR GEOMAGNETISM
Feb. 1964 80 p refs

Presented in this catalog is a list of geomagnetic stations and tables showing the status of data collections in geomagnetism and earth current measurements. Also included is a list of publications of geomagnetic data. P.V.E.

N64-22514 Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
ATOMIC COLLISION PROCESSES RELATING TO THE ATMOSPHERE
W. H. Kasner and A. V. Phelps 27 May 1964 67 p refs
(Contract DA-31-124-ARO(D)-99; DASA-WEB-07.010)
(AROD-3511-1; AD-441217)

Combined microwave, mass spectrometric, and optical techniques have been used to study the afterglow decay of electrons, ions, and excited atoms from microwave discharges in gas mixtures. Studies have been carried out in N_2-Ne mixtures under conditions where N_2^+ is the only significant afterglow ion, i.e., at nitrogen pressures less than 5×10^{-3} torr. Optical absorption studies show that neon metastable atoms, an undesirable ionization source, are present in the afterglow, the concentration being inversely related to the discharge pulse length. Under conditions of no detectable metastable concentration and for neon pressures in the range 15 to 30 torr, the afterglow decay is controlled by the recombination of N_2^+ ions and electrons, yielding a recombination coefficient $\alpha(N_2^+) = (2.9 \pm 0.3) \times 10^{-7}$ cm^3/sec. The variation of the metastable decay rate with nitrogen pressure gives a cross section of $(5.4 \pm 1.0) \times 10^{-16}$ cm^2 for the deexcitation of the $^3P_2$ neon metastable state by nitrogen molecules. At higher nitrogen pressures and shorter discharge pulse lengths (25 to 50 μsec) the recombination controlled afterglows are dominated by N_4^+ ions, the resulting recombination coefficient being approximately 2×10^{-6} cm^3/sec. Author

N64-22609 Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
EQUATORIAL LOCI OF THE EARTH'S MAGNETIC FIELD AND COSMIC RAY PARAMETERS
E. J. Chernosky, J. M. Collins, and M. P. Hagan (Emmanuel Coll.) Mar. 1964 20 p refs *Its* Environ. Res. Papers, No. 5
(AFCRL-64-174; AD-601055)

In addition to the magnetic dip and geomagnetic dipole equators, other magnetic field parameters can be used to define other equators. A total intensity minimum and the horizontal intensity maximum mark equators that differ notably from the dip and dipole equators. The locus of points where the orientation of the magnetic field lines is referred to the mean noon altitude of the sun at equinox, rather than to the earth's surface as is ordinarily done, coincides well with the dip equator and the Katz, Meyer, and Simpson aircraft cosmic ray equator. Other loci referred to the noon sun at solstice indicate the possibility of a seasonal latitudinal change in the cosmic ray equator. This change is in agreement with seasonal changes noted in measurements made on some equatorial crossings. Positions of the symmetrical field equators are determined from the first-order terms of a Fourier analysis of the latitudes of the various equators. A numerical evaluation of the variability and separation of the different equators is also made. Author

13 HEAT TRANSFER AND THERMODYNAMICS

Includes ablation; cooling; heating; and other thermal effects. *For aerothermodynamics see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings, Rotors, and Control Surfaces. *For combustion see*: 26 Propellants and Combustion. *For related information see*: 11 Fluid Mechanics.

N64-21541* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASUREMENTS OF RADIATIVE HEATING ON SHARP CONES
Dale L. Compton and David M. Cooper N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-252) AIAA: $0.50 members, $1.00 nonmembers

The use of sharp entry bodies, such as pointed cones, will reduce the total aerodynamic heating for entries into the earth's atmosphere at velocities in excess of escape velocity. The results are presented of free-flight range measurements of radiative heat load to conical models. A method of predicting the radiative heat load is developed, and a comparison is made of the measurements of radiation with the predictions. The models used for testing were 30° half-angle, right-circular cones with a base diameter of 1.02 cm. Nominal test velocity was 7.0 km/sec; actual test velocities varied from 5.7 to 7.3 km/sec. Models were launched from a 0.50 caliber, deformable-piston, light-gas gun. A.W.

N64-21542* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
MEASUREMENT OF HEMISPHERICAL TOTAL EMITTANCE AND NORMAL SOLAR ABSORPTANCE OF SELECTED MATERIALS IN THE TEMPERATURE RANGE 280° TO 600° K
Henry B. Curtis N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-256) AIAA: $0.50 members, $1.00 nonmembers

A steady-state heat-balance method is used in making measurements of thermal-radiation parameters. The hemispherical total emittance and normal solar absorptance are measured in the temperature range 280° to 600° K. Results are given for the following surfaces, which are applied to an aluminum substrate; four plasma-sprayed ceramics—zirconium silicate, strotium titanate, calcium titanate, and barium titanate; two ceramics applied by the Rokide process—Rokide MA and Rokide ZS; anodized aluminum, plain and electrophoretically blackened; two multiple layer coatings; and tile coat paint. Author

N64-21573 Naval Weapons Evaluation Facility, Albuquerque, N. Mex.
AN ANALYSIS OF THE TEMPERATURE-TIME DATA OBTAINED FROM A STEEL CYLINDER ENGULFED BY AN AIRCRAFT-FUEL FIRE
Albert C. Giere 29 Feb. 1964 21 p refs
(NAVWEPS-8292; AD-434800)

The mode of heat transfer to the surface of an object engulfed by a fire is of fundamental importance since it forms the boundary condition at the surface of the object when the heat conduction equation is solved. In the method proposed, two quantities characteristic of the fire environment are defined. The constant heat flux can be due either to radiative heat transfer alone or to a combination of radiative and convective heat transfer. An analysis of previous test data showed that if these two quantities are known the temperature–time history of an object engulfed by the flames of an aircraft-fuel fire can be predicted. A more accurate method for predicting the temperature–time history of an object engulfed by an aircraft-fuel fire is given; however, it is a more complex method and requires more accurate foreknowledge of Q and T_f. In this report, the method proposed for predicting the temperature–time history of a solid cylinder engulfed by an aircraft-fuel fire is further developed, and another set of test data is employed to substantiate the method. Author

N64-21580 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
INVESTIGATION OF THE TEMPERATURE FIELD IN AN ASYMMETRICALLY HEATED SANDWICH PLATE WITH A HONEYCOMB CORE
M. S. Povarnitsyn 22 Apr. 1964 12 p ref Transl. into ENGLISH from Inzh. Fiz. Zhurnal (Minsk), v. 4, no. 10, p 64–70
(RSIC-169; AD-600130)

The problem of asymmetrical kinetic heating of a sandwich plate with honeycomb core is considered. Heat transfer in the plate is due to thermal conduction and cross radiation. A formula for effective thermal conduction is obtained. A simple solution of the problem is proposed for the case in which the temperature of the outer surfaces of the plate has only a slight relation to the coordinates. N.E.A.

N64-21592 General Electric Co., Santa Barbara, Calif.
RADIANT EMISSION FROM HIGH TEMPERATURE EQUILIBRIUM AIR
Douglas H. Archer 18 Oct. 1963 44 p refs
(Contract DA-49-146-XZ-038)
(DASA-1435; RM-63TMP-44; AD-431737)

The spectral distribution of the energy radiated by equilibrium air in the temperature range from 3,000° to 9,000° K was computed for density ratios of 10^{-4}, 10^{-5}, and 10^{-6}. The results are an extension of the work of Breene and Nardone to the lower density ratios, and cover the wave number range from 1,250 to 56,000 cm^{-1}. Author

N64-21687 Space Technology Labs., Inc., Redondo Beach, Calif. Aerosciences Lab.
THERMAL RADIATION FROM THE EXHAUST PLUME OF AN ALUMINIZED COMPOSITE PROPELLANT ROCKET
Technical Report No. 6121-7904-RU-000
S. J. Morizumi and H. J. Carpenter Jan. 1964 37 p refs
(Contract AF 04(694)-1)
(BSD-TDR-64-16; AD-431500)

A technique is developed for calculating rocket base heating and spacecraft heating environments due to particle radiation from a single nozzle rocket exhaust plume. The analysis treats radiation from a cloud of particles as that from an equivalent radiating surface. Thus, the problem is reduced to the determination of the proper values of the apparent surface emissivity and the effective temperature. The particle flow field information (particle concentrations, temperatures, and trajectories) necessary to determine these two quantities is provided by a two-phase flow field computer program. Author

N64-21714 ARO, Inc., Arnold Air Force Station, Tenn.
A DATA REDUCTION PROGRAM FOR HOTSHOT TUNNELS BASED ON THE FAY-RIDDELL HEAT-TRANSFER RATE USING NITROGEN AT STAGNATION TEMPERATURES FROM 1500 TO 5000° K
Martin Grabau, H. K. Smithson, Jr., and Wanda J. Little Arnold Eng. Develop. Center, Jun. 1964 66p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-50; AD-601070)

A method is set forth for the computation of test-section, after-shock, and stagnation conditions in hotshot tunnels using nitrogen at stagnation temperatures from 1,500° to 5,000° K. The basic input data are the stagnation pressure in the reservoir, the pitot pressure behind a normal shock, and the heat-transfer rate at the stagnation point. The value of the overall enthalpy is adjusted by numerical iteration until the measured and computed heat-transfer rates are numerically equal within a prescribed tolerance. Author

N64-21717 ARO, Inc., Arnold Air Force Station, Tenn. Aerospace Environmental Facility
MODIFICATION OF SUPERSONIC FLOW FIELDS UNDER NEAR SPACE CONDITIONS BY CRYOPUMPING
J. A. Collins, Jr., D. E. Anderson, and W. D. Clement Arnold Eng. Develop. Center, Jun. 1964 41 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-66; AD-601089)

Results are presented of a test program designed to simulate an air-sampling probe utilizing cryosurfaces cooled to liquid helium temperature to capture the impinging gas. Capture coefficients are given for the liquid helium cooled cryosurface under the conditions of normally directed low-density gas flow from a Mach 3 nozzle for both clean, polished surfaces and surfaces coated with a thin film of paraffin. Also presented are the effects of micron-size particles in the gas on the cryopumping capabilities of the cryosurface. Author

N64-21718 CryoVac, Inc., Columbus, Ohio
RESEARCH STUDY OF THERMODYNAMIC SYSTEMS FOR TEMPERATURE CONTROL OF HEAT SINKS IN SPACE SIMULATION CHAMBERS
C. B. Hood, Jr., W. W. Vogelhuber, C. B. Barnes, and R. F. Barron Arnold Eng. Develop. Center, Jun. 1964 112 p
(Contract AF 40(600)-1032)
(AEDC-TDR-64-121; AD-601052)

The selection of a specific type of thermodynamic system for temperature control of the heat sink and cryopanel surfaces in a space simulation chamber is vitally important because of facility first cost, facility operating cost, facility usefulness or flexibility, ease of operation and use, reliability, and effect on heat sink design. Several systems that could be used for effecting temperature control of the heat sink surfaces in the range between 20° and 373° K were examined in the light of these considerations. Also, where several systems could provide the same temperatures, an economical comparison was made. Thus, the first cost and operating cost of an air-separation plant were compared to a nitrogen reliquefier, and the break-even point between a nitrogen reliquefier and a nitrogen subcooled circulation system was evaluated. Considerable attention was given to determining the relationship between the heat sink temperature and/or temperature profile and the simulator performance or capability. The areas of cryopumping, vehicle equilibrium temperature, and the simulation temperature error as determined by an electrical network analogy, were investigated. In addition, several generalized parameters were developed regarding the heat sink warmup process from operating temperatures to some elevated temperature utilizing helium or nitrogen gas for the heat-transfer fluid. Author

N64-21738 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

INSTRUMENTATION FOR MEASURING THERMAL CHARACTERISTICS OF SURFACES. PART I—A SPECTROPHOTOMETER WITH INTEGRATING-SPHERE REFLECTANCE ATTACHMENT

J. Porter and E. A. W. Butler Jan. 1964 22 p
(RAE-TM-SPACE-28)

The heat balance and thus the temperature distribution within a satellite or space vehicle are largely dependent on the thermal radiative characteristics of the satellite or space vehicle surfaces. This report discusses the thermal radiation fluxes in space and the need for and methods of evaluating the thermal radiative characteristics of the surfaces of materials. The operation and maintenance of equipment used for the evaluation of the reflectances of material surfaces over the spectral range 210 to 2,700 mμ are described. Author

N64-21843* National Bureau of Standards, Boulder, Colo.

SURVEY OF CURRENT NBS WORK ON PROPERTIES OF PARAHYDROGEN

R. D. Goodwin, D. E. Diller, W. J. Hall, H. M. Roder, L. A. Weber et al Repr. from Advances in Cryogenic Eng., v. 9, 1964 p 234–242 refs
(Jointly Supported by NASA)
(R-315-D-9)

Concise descriptions of various thermodynamic properties of parahydrogen at low temperatures and high pressures are presented to supplement a previously published compilation of hydrogen properties. A density–temperature phase diagram is shown to indicate the region selected. The properties and functions described are PVT data for single phases, virial coefficients, two-phase boundaries, densities on the boundaries, critical constants, heats of vaporization, specific heats of saturated liquid and of fluid states, Joule–Thomson inversion curve, sonic velocities, and dielectric constant of compressed liquid. D.S.G.

N64-21873 Los Alamos Scientific Lab., N. Mex.

A STUDY OF TEMPERATURE MEASUREMENT PRECISION IN DEBYE–SCHERRER SPECIMENS DURING HIGH TEMPERATURE X-RAY DIFFRACTION MEASUREMENT OF THERMAL EXPANSION

R. G. Merryman 22 May 1964 108 p refs
(Contract W-7405-ENG-36)
(LA-2687)

An internal standard of gold was calibrated and can be used for the precise temperature measurement of Debye–Scherrer specimens in high-temperature X-ray-diffraction measurements of thermal expansion. The calibration method consisted of measuring the lattice parameters of a selected gold wire specimen in which the gold specimen formed one leg of a Pt-Au thermocouple with both specimen and thermocouple junction in the X-ray beam. The internal standard is used by mixing gold powder, selected to match the analysis of the gold wire, with the Debye–Scherrer specimen and translating the gold lattice parameters to temperature from tables of a versus t for gold. The lattice parameter a for Au and MgO was measured with precisions of 13.5×10^{-5} A and 15.5×10^{-5} A, respectively; and the average coefficient of linear thermal expansion, $\bar{\alpha}$, for Au and MgO was determined with precisions of 0.08×10^{-6}/°C and 0.07×10^{-6}/°C, respectively. A Pt/Pt-10% Rh thermocouple in contact with the Debye–Scherrer specimen gave errors as high as 85° C in the measurement of sample temperature. Author

N64-21936 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE HEATING OF BODIES IN MOTION AT HIGH SUPERSONIC SPEEDS

G. I. Sakharov, V. V. Andreyevskiy, and V. Z. Bukreyev 20 Dec. 1963 137 p refs Transl. into ENGLISH from the book "Nagrev Tel Pri Dvizhenii S Bol'shimi Sverkhzvukovymi Skorostyami" Moscow, Gos. Nauchno-Tekhn. Izd. Oborongiz, 1961 p 3–106
(FTD-TT-63-816/1+2; AD-435639)

This book examines problems relating to the gas kinetic (aerodynamic) heating of the surface of a flying craft. A method is presented for the calculation of heat flows from the environment to the surface of the flying craft and of the flows of heat scattered from this surface into space. The method of calculating the equilibrium temperature of the surface is examined, as well as the method of calculating the temperature of the heat-absorbing skin. The influence of high temperatures on aviation designs is examined, and a brief review of the basic methods employed to control aerodynamic heating is presented. Author

N64-21949 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

COSMIC COLD (HORIZONS OF SCIENCE)

B. Verkin, A. Galkin, and I. Dmitrenko 12 Jun. 1963 7 p Transl. into ENGLISH from Izvestiya (Moscow), 2 Nov. 1960 p 6
(FTD-TT-63-513/1; AD-412880)

The properties of various materials at ultralow temperatures are discussed, along with ways in which these properties can be used in space applications. P.V.E.

N64-21960 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE THERMAL BARRIER

N. Zhovinskiy 3 Jan. 1964 13 p Transl. into ENGLISH from Kryl'ya Rodiny (USSR), no. 7, 1957 p 11–13
(FTD-TT-63-976/1+2; AD-430014)

Flights at velocities exceeding the speed of sound lead to difficulties connected with the heating of flying devices. This report describes, briefly, the causes of heating, to what heating leads, and how to protect the flying apparatus against heating. N.E.A.

N64-21974 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THERMAL STRESSES IN AIR COOLED DISKS OF ROTARY GAS TURBINES

E. Tuliszka 11 May 1964 24 p refs Transl. into ENGLISH from Tech. Lotnicza (Poland), no. 7, 1963 p 168–176
(FTD-TT-64-145/1+2; AD-600506)

A method of calculating the temperature distribution in air-cooled rotary turbine disks and of analyzing the induced thermal stresses is presented. The effect of the length of slots on the mechanical loads and on the thermal stresses is considered. The method can be used for optimum design of cooling airstream geometry and of depth of slot notching for various disk profiles. M.P.G.

N64-22053 Mc Donnell Aircraft Corp., St. Louis, Mo. Structures Lab.

EVALUATION OF RESISTANCE AND RADIANT HEATING METHODS FOR HIGH TEMPERATURE TENSILE TESTING Final Report

J. Sveitio 10 Jan. 1963 19 p
(Contract AF 33(657)-7749)
(Rept.-9347; AD-294537)

In order to evaluate the test results obtained when elevated temperature tensile specimens are heated by quartz radiant lamps and by electrical resistance of the specimens, three materials were tested at various elevated temperatures and at three different strain rates. The materials subjected to testing were HM21-T81 magnesium alloy at 700° F, type 321 stainless steel at 1,600° F, and Inconel X at 1,200° F. The generally close agreement between the elevated-temperature tensile data obtained when specimens were heated by each method indicated that reliable mechanical property data can be determined by either test procedure. Radiant lamp heating requires less complicated specimen preparation and heating equipment; however, resistance heating offers more rapid heating, the ability to control a temperature gradient without changing the physical position of heaters, and the absence of effects of specimen discoloration. Author

N64-22093* Ling-Temco-Vought, Inc., Dallas, Tex. Astronautics Div.
DEVELOPMENT AND APPLICATION OF A NEW APPROACH TO HEAT SHIELD THERMAL DESIGN AND EVALUATION
J. E. Medford [1964] 13 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(Contract NAS9-576)
(AIAA Paper-64-259) AIAA: $0.50 members, $1.00 nonmembers

A new approach to thermal design and evaluation of atmospheric entry heat shields was applied to development of a radiative–ablative concept. This concept consists of an outer layer of carbonaceous material and an inner layer of charring ablative material. The necessary equations to represent physical processes were derived and programed on the IBM 7090 computer. Refinements to the analytical model were made by carrying out thermal tests in existing plasma arc and radiant heat lamp facilities and adjusting material property data to obtain good agreement between test and analysis. A heat shield was sized for a typical superorbital earth reentry vehicle, and weight and thermal response analyses were performed. Agreement between theoretical and experimental results was, in general, quite good. Author

N64-22134 National Aeronautical Lab., Tokyo (Japan)
THERMAL CHARACTERISTICS OF A PEBBLE-BED HEATER
Nisiki Hayasi 1963 17 p refs in JAPANESE; ENGLISH Summary
(NAL-TR-52)

The heat transfer between pebbles contained in a circular tube and the fluid moving through it were considered. Neglecting the effect of the heat capacity of the wall, several analyses were made for the following cases: (1) The initial temperature of pebbles is equal to that of fluid and is uniform. (2) The thermal capacity per unit volume of fluid is far less than that of pebbles, and the initial temperature of pebbles is a linear function of $e^{-c\xi}$, where c is a constant and ξ is a nondimensional axial distance. Numerical calculations were done for two pebble-bed heaters by means of an electronic digital computer. Author

N64-22135 National Aeronautical Lab., Tokyo (Japan)
THERMAL CHARACTERISTICS OF THE UNSTEADY FLOW THROUGH A CIRCULAR PIPE WHOSE TEMPERATURE DEPENDS ON TIME AND FLOW-DIRECTIONAL DISTANCE ONLY
Nisiki Hayas 1963 22 p refs in JAPANESE; ENGLISH summary
(NAL-TR-53)

An analysis of the heat transfer between a circular tube and the fluid moving through it was made for the case where the temperature of inlet fluid was constant. The temperature of the tube was assumed as independent on radial distance. When the heat loss through the wall is small, the final result reduces to a convenient form for calculation using graphs that are included. Author

N64-22148 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A STUDY OF HEAT TRANSFER IN A CIRCULAR CHANNEL
Kh. A. Barlybayev and S. V. Bukhman 30 Jan. 1963 17 p refs Transl. into ENGLISH from Izvest. Akad. Nauk Kazakh. SSR, Ser. Energ., no. 1(19), 1961 p 21–29
(FTD-TT-62-1642/1+2+4; AD-400520)

The steady-state hydrodynamically and thermally stabilized flow of an incompressible fluid, with constant physical parameters, along a circular channel formed by two coaxial cylindrical pipes is considered in order to determine some qualitative laws that are preserved when the flow becomes turbulent. Results of the analysis are as indicated: (1) The geometry of the channel has the main effect on the temperature field and heat transfer, and the asymmetry of the temperature profile is a function of the ratio of the radii. (2) The heat transfer is more intensive for the inner walls of a circular channel, especially at high ratios of the outer and inner pipes of the circular channel. (3) When the heat flow through the walls of the channel is constant, the temperature maximum is slightly dependent upon the velocity profile. M.P.G.

N64-22163 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANALOG STUDY OF THE EFFECT OF THERMAL CONDUCTIVITY OF A MATERIAL ON THE HEAT IN A TURBINE BLADE
J. Kunes and O. Vavroch 4 May 1964 16 p Transl. into ENGLISH from Strojirenstvi (Prague), v. 12, no. 11, 1962, p 842–846
(FTD-TT-64-146/1+2; AD-600609)

This is a study of thermal fields in structural installations. The effect of thermal-conductivity changes of the material can be disregarded. Described is a method based on gradual analog approximations, which enable a substantial simplification of the mathematical chalengeing exercise, on how to determine the thermal field with consideration of changes in thermal conductivity with the rising temperature of the material. A concrete example shows how such effect may appear in a cooled turbine blade. Author

N64-22165 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TEMPERATURE FIELD AND GRADIENTS IN ELEMENTS OF WELDED DISK TYPE TURBINE ROTOR UNDER STARTING CONDITIONS
V. I. Fedorov, M. O. Minyaylenko, and S. S. Rusakov 9 Nov. 1962 9 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Ukraine), no. 10, 1961 p 1317–1322
(FTD-TT-62-1363/1+2; AD-292206)

Investigations of temperature distribution in a disk-type welded rotor under starting conditions were carried out on hydrointegrators. The initial and boundary conditions of heat exchange, at which the investigations have been carried

out, corresponded to turbine-starting conditions. Characteristic in the construction of a disk-type rotor is the sharp change in rotor profile at the zone where the disk is jointed with the cylinder, which ordinarily leads to irregularity in the heating of these elements. The object of investigation of the temperature field was the zone where the disk is jointed with the hollow cylinder, at which point considerable temperature gradients and stress concentrations do originate. N.E.A.

N64-22245 Boeing Co., Seattle, Wash.
DEVELOPMENT PROGRAMS, THERMAL INSULATIONS, X-20
Walter S. Perkowski [1963] 186 p
(Contract AF 33(657)-7132)
(D2-80283; AD-433572)

This document outlines the development of thermal insulation systems for the X-20 glider. Two general types of insulation were developed: (1) High-temperature insulation provides thermal protection for the glider primary structure and reduces the heat load to the "water-wall" active cooling system for the glider inner compartments. This insulation must operate satisfactorily at temperatures to 3,000° F. (2) Cryogenic insulation is necessary for the glider environmental control and for the auxiliary-power cryogenic fluid tankage and transfer systems. The required operating temperature range of this insulation was −423° to 250° F. A commercial microquartz fibrous insulation, Q-felt, was chosen for the high-temperature application. Evacuated multilayer (super) insulation was chosen for the X-20 cryogenic tanks and transfer tubes. N.E.A.

N64-22309 Avco-Everett Research Lab., Everett, Mass.
INFRARED TEMPERATURE MEASUREMENT OF THE LAMINAR WAKE OF A HYPERSONIC SPHERE RESEARCH REPORT NO. 179
L. A. Young May 1964 51 p refs
(Contracts DA-30-069-ORD-1955; AF 04(694)-414; DA-19-020-AMC-0210; Proj. Defender)
(BSD-TDR-64-32; AD-440874)

The temperature of the laminar wake of a 0.22-in.-diam nylon sphere traveling at 13,000 ft/sec in a ballistic range filled with 95% N_2 and 5% CO_2 was measured by observing the infrared radiation from the CO_2 with a gold-doped germanium infrared detector and a 4.39-μ narrow-band filter. The results are compared with theoretical wake temperatures obtained by the cooling of the shock-heated gas as it expanded to ambient pressure and calculated by a streamtube chemistry program; a simple heat conduction calculation was carried out. In the region from 50 to 400 body diameters behind the sphere the experimental CO_2 vibrational temperatures agree with the calculated translational temperatures within the scatter of the data. For example, at 200 body diameters the measurements give 1,230° K on the centerline while the theoretical temperature is 1,410° K. Nearer the body the experimental values are as much as 600° K higher than calculated; a possible explanation for the discrepancy is discussed in the text. Author

N64-22329 Air Force Systems Command, Wright-Patterson AFB, Ohio AF Aero Propulsion Lab.
LOW-GRAVITY POOL-BOILING HEAT TRANSFER
Robert Glen Clodfelter Mar. 1964 46 p refs
(APL-TDR-64-19; AD-437803)

This paper presents the results of an investigation into the characteristics of pool boiling at reduced gravity. Experimental data taken in a 1.8-sec drop tower, using water as the test fluid, are given for a 0.020-in.-diam platinum wire and 1/8-in. and 1/4-in. platinum ribbons. In the range of nucleate boiling, no significant influence of gravity or geometry was observed whereas the critical heat flux was affected by both gravity and the geometry of the container as well as by the time at reduced gravity. Author

N64-22341 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
VAPORIZATION OF SOLIDS BY ABSORBED RADIATION ENERGY
E. M. Shakhov 10 May 1963 24 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 1, no. 4, 1961 p 27–38
(FTD-TT-63-77/1+2; AD-414715)

The unidimensional problem of the vaporization of a solid body heated by the incident radiant energy it absorbs is considered. The absorption is assumed to occur on the surface, and the radiation flux is considered to be equivalent to a heat flow q along the boundary whose magnitude depends on surface temperature and time t. Two cases of evaporation are considered: (1) evaporation from the surface of a body initially contiguous to a vacuum; and (2) evaporation from the surface of a body into an ambient space filled with gas. In the first case, the loss of solid mass per unit of evaporating surface proceeds at a rate that depends only upon the temperature of the body surface and is therefore solved independently of the gas motion. In the second case, most of the evaporation products that are removed from the surface by diffusion are recondensed on the surface due to the near-equilibrium state set up in the surrounding vapor. Ageneral nonlinear solution is derived, as an implicit expression for surface temperature, if the value of the heat flux does not depend on surface temperature. M.P.G.

N64-22357 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RESULTS OF CERTAIN HEAT-ENGINEERING INVESTIGATIONS
V. D. Yusufova 10 Feb. 1964 22 p refs Transl. into ENGLISH from Tr. Energ. Inst. Izd. AN SSR, no. 15, 1962 p 180–194
(FTD-TT-63-922/1+4; AD-432181)

Results of the following engineering investigations are presented: (1) the thermodynamics of gases deviating from the ideal; (2) the theoretical basis of new methods for plotting polytropic curves of ideal gases; (3) the determination of the distribution constant of petroleum hydrocarbons and narrow petroleum fractions; (4) the determination of the thermodynamic properties of individual hydrocarbons; (5) the determination of the heat-transfer coefficients in factory heat-exchangers during the boiling of benzene and kerosene; (6) the process of heat transfer during the condensation of individual hydrocarbons as a function of different steam parameters and the geometrical arrangement of the condenser, e.g., the process of the condensation of benzene and toluene within a horizontal pipe in a laboratory arrangement; (7) the process of heat transfer from the flow of a mixture of air and aluminosilicate powder (the catalyst in the petroleum cracking process) to the wall of the cooling pipe during various regimes of motion of a two-phase flow; (8) the semicoking of oily acid tars for the purpose of using them as a solid fuel; (9) the ascertaining of the conditions for the activation of the focus of combustion pertinent to the thermal use of underground stratification of petroleum; and (10) the determination of the properties of Azerbaidzhan oil shales as an energy-producing fuel. I.v.L.

N64-22371 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
AN INVESTIGATION OF THE THERMAL CONDUCTANCE OF BOLTED JOINTS
Ian D.C. Andrew London, Min. of Aviation, Jan. 1964 38 p refs
(RAE-TN-WE-46)

For a particular bolted joint between aluminum alloy specimens, the effects on thermal conductance of surface roughness, of surface flatness, of tension in the bolt, and of the presence of insulating inserts in the joint were investigated. Surface flatness was more critical than surface roughness. There was little variation of thermal conductance with an increase in bolt torque above the normal working value of 200 lb-in. (30% of the 0.01% proof load). With a resin bonded fabric insert between the 1-sq-in. mating surface of the joint, and a particular type of bolt (Unbrako 3/8-in. diameter), which was in metal–metal contact with the jointed members, for a constant heat source, there was no reduction in the total rate of heat flow through the overall joint for insulating inserts thicker than 0.03 in. Author

N64-22394 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HYDRODYNAMICS AND HEAT TRANSFER OF THE TURBULENT FLOW OF AN INCOMPRESSIBLE FLUID IN THE GAP BETWEEN ROTATING COAXIAL CYLINDERS

Yu. A. Koshmarov 24 Jan. 1963 16 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 5, no. 5, 1962 p 5–14 (FTD-TT-62-1743/1+2+4; AD-299645)

The article gives theoretical solutions of the hydrodynamic and thermal problems for the steady-state turbulent flow of an incompressible fluid in an annular channel formed by two smooth coaxial cylinders rotating with respect to each other. Author

N64-22399 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HEATING OF A PLATE AT A SHIFTING HEAT EXCHANGE SURFACE

K. N. Chakalev 13 Feb. 1963 10 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 5, no. 4, 1962 p 25–30 (FTD-TT-62-1770/1; AD-299857)

An approximate solution was obtained for the problem of nonstationary heat transfer for an unlimited plate on the surface of which physical and chemical transformations are taking place. Relationships are obtained by means of which the rate of motion of a melting front and heat flow within the solid part can be determined by calculation; temperature change in time at some point within the plate is assumed to be known. Author

N64-22406 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THEORY OF THE DISCHARGE OF A BOILING LIQUID THROUGH A SWIRL JET

V. A. Makhin, V. F. Prisnyakov, and I. F. Tokar' 5 Feb. 1963 18 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeniy, Aviats. Tekhn. (USSR), no. 3, 1962 p 166–176 (FTD-TT-62-1836/1+2+4; AD-299632)

A method for calculating the discharge of a boiling liquid through a jet nozzle is presented. Graphs, showing the dependence of the flow rate of an emulsion on the saturated vapor pressure in a tank for those jets on which the experiments were conducted, were calculated and were constructed to verify the proposed method of calculating the discharge of a boiling liquid. Experiments were conducted on two helical jets. The maximum deviation between the calculated and experimental data for all investigations of the discharge of water and mixtures (polymer distillate, 56%; light pyrolysis oil, 40%; tricresol, 4%; N_2O_4, 27%; and HNO_3, 73%) was less than 10%. P.V.E.

N64-22413* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENTAL STUDY OF RADIATIVE TRANSPORT FROM HOT GASES SIMULATING IN COMPOSITION THE ATMOSPHERES OF MARS AND VENUS

Carlton S. James Repr. from the AIAA J., v. 2, no. 3, Mar. 1964 p 470–475 Presented at the AIAA Conf. on Phys. of Entry into Planetary Atmospheres, Cambridge, Mass., 26–28 Aug. 1963 Previously Issued as AIAA Paper 63-455; see N63-20136 20-28
(NASA-RP-174)

Measurements have been made of gross spectral quality and intensity of thermal radiation from the hot gas cap of small polyethylene models flying through mixtures of CO_2 and N_2. Mixture proportions and ambient pressure were varied from pure N_2 to nearly pure CO_2 and from 0.004 to 0.08 atm, respectively. Model flight velocity varied from 5 to 8 km/sec. Strong radiation from CN, formed in the shock layer, is observed for a wide range of mixture proportions. Variation of the total intensity of gas-cap radiation with ambient pressure, flight velocity, and mixture proportions is defined. Radiation from the mixtures is compared with radiation from air. The total intensity of gas-cap radiation from the CO_2-N_2 mixtures is found to be several times that from air at the same flight conditions, except when high CO_2 concentrations are combined with low velocities. Comparison of the measurements with available equilibrium calculations indicates agreement within factors of two or three over the test range. Author

N64-22466* Midwest Research Inst., Kansas City, Mo.

ORBITING SATELLITE SURFACE TEMPERATURE PREDICTION AND ANALYSIS—USER'S MANUAL

H. L. Finch and D. Sommerville 26 Feb. 1964 46 p refs
(Contract NAS9-1059)
(NASA-CR-56278) OTS: $4.60 ph

The purpose of the program is to determine impinging radiation heat loads and/or transient temperatures of vehicles orbiting the Moon, Earth, or any other planet, except Pluto. One of the unique features of the program is the ability to compensate for surface temperature gradients of the celestial body being orbited, thereby making the program especially applicable to project Apollo and other moon programs. Hundreds of hypothetical test cases were run to check out specific routines and functions as well as the overall program. The Lunar Excursion Module moon voyage, being planned for the late 1960's, was simulated on the computer. The results confirmed the importance of the program's ability to account for the moon's surface temperature gradients. This feature eliminated large errors in determining lunar thermal emission and resulted in improved vehicle temperature predictions, in one case by ±100° R. Simulated runs gave time–temperature curves that closely approximated the actual curves of the Explorer and Vanguard satellites. Author

N64-22478* Connecticut U., Storrs School of Engineering

HEAT TRANSFER STUDIES OF VAPOR CONDENSING AT HIGH VELOCITIES IN STRAIGHT TUBES Interim Progress Report, Nov. 1, 1963–Apr. 30, 1964

C. H. Coogan, Jr., W. W. Hilding, W. Davis, M. J. Casarella, F. L. Robson et al 1 May 1964 16 p refs
(Grant NsG-204-62)
(NASA-CR-56238) OTS: $1.60 ph

Emphasis was placed on design, construction, and debugging of the test apparatus for determining pressure drop as a function of the heat-transfer rate. The test apparatus and test procedure are described. A complete set of test data has yet

to be obtained, although several runs using the velocity pressure probe were made in the interest of developing test procedures. Data are presented on static pressure as a function of tube length and on tube wall and cooling water temperature as a function of tube length. I.v.L.

N64-22519 Brown U., Providence, R.I. Applied Mathematics Div.
ON THE INFLUENCE OF CORIOLIS FORCES ON ONSET OF THERMAL CONVECTION Technical Report No. 54
P. P. Niiler and F. E. Bisshopp May 1964 22 p refs
(Contract Nonr-562(07))
(Rept.-562(07)/54; AD-600590)

The effect of Coriolis forces on the onset of thermal convection in a shallow layer of viscous liquid is studied in the limit of rapid rotation of the layer. The cases of both free and rigid boundaries are considered. Author

N64-22585 Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
DRASTIC REDUCTION OF WARM-UP RATE WITHIN A DEWAR SYSTEM BY HELIUM DESORPTION
Peter D. Gianino Jan. 1964 12 p refs *its* Phys. Sci. Res. Papers No. 9
(AFCRL-64-17; AD-601054)

A method is described whereby the time rate of temperature change is drastically reduced within a glass double-dewar system over the interval 4.2° to 77° K. The problem of reducing the rate of change is solved successfully by inserting a small amount of activated charcoal in the inner dewar. The explanation of why it succeeds is presented, and results are given showing the drastic reduction of warmup rate for various amounts of charcoal. Some advantages of such a simple scheme are listed. Author

N64-22571 Ohio State U., Columbus
STAGNATION POINT HEAT TRANSFER IN HIGH ENTHALPY GAS FLOWS. PART I: CONVECTIVE HEAT TRANSFER IN PARTIALLY IONIZED AIR Technical Documentary Report, Feb. 1963 - Feb. 1964
Robert M. Nerem and George H. Stickford Wright-Patterson AFB, Ohio, Flight Dyn. Lab., Mar. 1964 50 p refs
(Contract AF 33(657)-10110)
(FDL-TDR-64-41, Pt. 1; AD-601370)

Using an arc-driven shock tube facility, measurements of convective heat transfer at the stagnation point of a blunt body were carried out at simulated flight velocities ranging from 20,000 to 40,000 fps. These measurements were performed using standard calorimeter techniques with air as the test media. The present results indicate no significant ionization effects on aerodynamic heating, and indicate that Lee's approximate equation for stagnation-point heat transfer can be used for engineering calculations at flight velocities up to 40,000 fps. Author

N64-22625 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ANALYSIS OF EXPERIMENTAL THERMAL VALUES AND EQUATION OF STATE FOR HYDROGEN
V. A. Rabinovich 11 Jan. 1963 14 p refs Transl. into ENGLISH from Inzh.-fiz. Zh., (USSR), v. 5, no. 5, 1962 p 30–37
(FTD-TT-62-1569/1+2+4; AD-422059)

Detailed analysis is made of the pvt data of various experimenters, and this is used to derive a grid of reference values for thermal quantities. An equation of state is set up for hydrogen, and the feasibility of extrapolating it into the high-temperature region while allowing for the dissociation of hydrogen molecules is demonstrated. Author

N64-22628 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WE ARE CONDENSING HELIUM
Jan Prusak 11 Mar. 1963 6 p Transl. into ENGLISH from Veda Tech. Mladezi (Czech.), no. 11 1962 p 368–369
(FTD-TT-62-1669/1+2; AD-299661)

The various uses for liquid helium and hydrogen are discussed and a diagram is presented of an installation used in their production. P.V.E.

N64-22674* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
HEAT-TRANSFER MEASUREMENTS ON A FLAT PLATE AND ATTACHED FINS AT MACH NUMBERS OF 3.51 AND 4.44
Earl A. Price, Paul W. Howard, and Robert L. Stallings, Jr. Jan. 1964 38 p refs
(NASA-TN-D-2340) OTS: $1.00

Heating distributions were obtained on three fixed-sweep fins (12.87°) of different leading-edge diameters, as well as on the flat-plate surface adjacent to these fins. Heating rates also were obtained on a flat plate adjacent to a fin through a range of fin sweep angles from 0° to 69°. The tests were conducted at Reynolds numbers per foot ranging from 2.5×10^6 to 4.2×10^6. Author

N64-22691 Ohio State U., Columbus
STAGNATION POINT HEAT TRANSFER IN HIGH ENTHALPY GAS FLOWS. PART II: SHOCK LAYER RADIATIVE EMISSION DURING HYPERVELOCITY RE-ENTRY
Robert M. Nerem Wright-Patterson AFB, Ohio., Flight Dyn. Lab. Mar. 1964 111 p refs
(Contract AF 33(657)-10110)
(FDL-TDR-64-41, Pt. II; AD-601371)

Experimental measurements of stagnation-point equilibrium radiative heat-transfer were performed over the range of simulated flight velocities between 26,000 and 52,000 fps, and at altitudes from 100,000 to 170,000 ft. These measurements were compared with existing theoretical estimates; and wide disagreement is shown to exist at high temperatures and low densities where the continuum emission due to the deionization of N^+ and O^+ dominates the shock-layer radiation. Using an approximate approach, a revised estimate is presented for the radiative emission from high temperature equilibrium air. This revised estimate is then applied to the determination of stagnation point equilibrium radiative heat transfer during reentry at superorbital velocities. A correlation for the shock-layer emission rate useful in engineering design calculations is presented. Author

14 HUMAN BEHAVIOR

Includes crew training and evaluation; piloting; and psychological factors. *For simulators see*: 10 Facilities, Research and Support. *For related information see*: 16 Life Sciences.

N64-21727* Yeshiva U., New York, N.Y. Albert Einstein Coll. of Medicine
IS REAFFERENCE NECESSARY FOR VISUAL ADAPTATION?

Sidney Weinstein, Eugene A. Sersen, Larry Fisher, and Marvin Weisinger Repr. from Perceptual and Motor Skills, v. 18, 1964 p 641–648 refs
(Grant NsG-489)

Two studies were performed to determine the necessity of reafference (stimulation due to self-induced movement) in the production of adaptation to prismatic displacement. In the first experiment 48 Ss exposed to laterally displacing prisms, were equally divided into four groups comprising combinations of each of the two following variables: self-induced versus passive movement, and self-directed versus externally directed motion. These groups were nondifferential in the magnitude of positive adaptation, although the total population adapted positively and significantly to the prisms. In the second experiment 17 Ss were tested before and after exposure to the same prisms in a situation that provided informational feedback regarding error and that eliminated self-produced movement. The group demonstrated significant positive adaptation. It is concluded that reafference is not necessary for adaptation and that informational feedback is, at least, sufficient and may be necessary for adaptation. Author

N64-21741 Army Personnel Research Office Washington, D.C.
PERFORMANCE OF SINGLE VS MULTIPLE VOICE RADIO TRANSCRIBERS WORKING UNDER THREE SPEECH TO NOISE RATIOS
A. E. Castelnovo, J. G. Tiedemann, and D. A. Dobbins Sep. 1963 33 p refs
(USAPRO-TRN-135; AD-432088)

Effort to improve work methods employed in the Army's monitor systems is critical to the assessment of human performance within the system and to the determination of system reliability. The present study reports on one segment of the research effort—improvement of work methods employed in producing a transcript. Three work methods, differing in the number of transcribers contributing to the final product, were compared with respect to accuracy and completeness of the resulting transcription. These methods were tested under three levels of noise that yielded high, medium, and low intelligibility under standard conditions. Data obtained were interpreted by analysis of variance technique. A small but consistent difference in favor of multiple transcriber work methods was found to exist. Differences were statistically significant only at the medium noise level. A secondary finding of potential value was that repeated exposures to a message resulted in some increase in accuracy at low and medium noise levels; repeated exposures at the high noise level were conducive to error. Author

N64-21840 General Electric Co., Cincinnati, Ohio Flight Propulsion Div.
INVESTIGATION OF THE NOISE ASPECTS OF CARRIER DECK JET ENGINE OPERATION, AND EFFECTS OF NOISE SUPPRESSION ON AIRCRAFT MISSION PERFORMANCE. VOLUME I: EFFECTS OF NOISE FROM CARRIER DECK JET ENGINE OPERATION ON HEARING, SPEECH INTERFERENCE AND SONIC FATIGUE
R. J. Wells, M. W. Schulz, and R. B. Tatge 31 Jan. 1964 129 p refs
(Contract NOw-62-0887-D; Phase II)
(AD-432086)

This report is part of a study undertaken to better define the parameters relative to the problem of an in-flight noise suppressor for carrier-based jet aircraft. This report is based almost entirely on literature reviews and on discussions held with research workers. The effect of noise on people and on structures is discussed. R.T.K.

N64-21920 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EXPERIENCE WITH THE PHYSICAL STRESSES OF REGULAR WEATHER-OBSERVATION FLIGHTS AT 5000 METERS AND THEIR REDUCTION THROUGH USE OF A PRESSURIZED SUIT
P. Klanke 14 Feb. 1963 15 p Transl. into ENGLISH from Luftfahrtmed. Abh. (Leipzig), v. II, no. 3–4, 1938 p 182–189
(FTD-TT-62-1424/1+3+4; AD-299617)

Work carried out in developing aircraft pressure suits is discussed. Physical stresses that are to be alleviated through the use of the suits are also discussed. P.V.E.

N64-21938 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STRESS AND FATIGUE UNDER ISOLATED CONDITIONS
F. D. Gorbov, V. I. Myasnikov, and B. I. Yazdovskiy 18 Mar. 1964 13 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 8, no. 4, 1963 p 585–592
(FTD-TT-63-1015/1+2+4; AD-435502)

Tests were conducted on men, each subject staying for various continuous periods (10 to 15 days), in the limited and closed space of a specially outfitted chamber. The experimental conditions were those of solitude, lack of two-way speech communication, and almost complete isolation from exernal sources of light, sound, and other stimulation. Beginning with the sixth to eighth days of the tests, the subjects experienced fatigue. A need for conversation, for direct contact with observer, was noted. During this time, there were periods lasting 20 to 30 min in which the subjects sat, outwardly indifferent, doing nothing. At this time, sufficiently indicative shifts were revealed in the level and period of alpha-rhythm exaltation after light stimulus. From the second day of the test, the alpha-rhythm amplitude began to decrease; on the sixth day, under isolated conditions, it was 25μv to 30μv and remained at that level to the end of the test. On the seventh day, the exaltation period had risen to 20 sec and was broken only by the next stimulus. Study of the motor response showed that the latent period had increased an average of 120 msec by the end of the experiment. P.V.E.

N64-21945 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE ROLE OF THE HUMAN FACTOR IN CONTROL SYSTEMS
Janusz Morawski 23 Aug. 1963 70 p refs Transl. into ENGLISH from Arch. Budowy Maszyn (Warsaw), v. 8, no. 4, 1961 p 369–409
(FTD-TT-63-331/1+2; AD-421191)

This is a mechanistic view of the man–machine relationship. The emphasis is on the role of man as operator, regulator, and controller of automated systems, and an attempt is made to categorize which functions are best performed by man and which by machine. The goal of human-engineering studies its to enable man to be used more effectively and to free him from mechanical routines best accomplished by machines. Common denominators are ascribed to both man and machine; these are analyzed with the idea of selecting the better performer for a given task, either singly or in cooperation. G.D.B.

N64-22061* Yeshiva U., New York, N.Y. Albert Einstein Coll. of Medicine
AN ATTEMPT TO REPLICATE A STUDY OF DISARRANGED EYE-HAND COORDINATION

Sidney Weinstein, Eugene A. Sersen, and Deanna S. Weinstein Repr. from Perceptual and Motor Skills, v. 18, 1964 p 629–632 refs
(Grants NsG-489; VRA-RD-427; NINDB-NB-03356)

Three groups of 15 subjects each were tested for disarranged eye–hand coordination in the distance dimension. All groups were tested using a bipartite box that permitted lighting only the upper or lower chambers. The subject was required to place a dot at the location of a virtual image of a target without seeing his hand. After making 30 such dots he was exposed to one of three conditions, after which he repeated the pre-exposure test. The three conditions were: (1) constrained self-produced hand movement with 7.6 cm. displacement, (2) free hand movement with 7.6 cm. displacement, (3) free hand movement without displacement (control). The results indicated a predominant proportion of individuals with negative adaptation in all groups. The two groups with reafference (stimulation through self-induced movement) and displacement did not differ significantly from the control group in the magnitude or the direction of adaptation. The results could not be predicted from reference to theory and do not conform to the results of Held and Schlank, in which positive adaptation was obtained in a similar mirror-displacing situation. Author

N64-22094* Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
DEVELOPMENT OF A COMPLEX MULTIPLE SCHEDULE IN THE CHIMPANZEE
Richard E. Belleville, Frederick H. Rohles, Marvin E. Grunzke, and Fogle C. Clark Repr. from J. Exptl. Analysis of Behavior, v. 6, no. 4, Oct. 1963 p 549–556 refs
(Proj. Mercury)
(NASA-RP-188)

The development of chimpanzee behavior on a four-component, three-lever multiple schedule is described. Component schedules included the Sidman avoidance procedure with a concurrent discriminated avoidance schedule on a second lever, fixed ratio performance for food, differential reinforcement of low rate for water requiring a dual response chain, and a symbol discrimination task for continuous food reinforcement using three levers. The avoidance component of this schedule was employed during the January 31, 1961, suborbital space flight of the chimpanzee Ham. On November 29, 1961, the chimpanzee Enos performed on the multiple schedule during three orbits around the earth in a Mercury capsule. Author

N64-22095 Federal Electric Corp., Paramus, N.J.
BACKGROUND AND SYNOPSIS OF THE CORRECTIVE MAINTENANCE BURDEN PREDICTION PROCEDURE
31 Jan. 1964 18 p
(Contract Nonr-3821(00))
(Rept.-64-34; AD-433165)

The Corrective Maintenance Burden Prediction Procedure (CMBPP) provides a means for determining the maintenance time by the skill level required to perform electronic corrective maintenance on an equipment or a system. The basic steps that an analyst would go through in using the CMBPP are outlined. Inherent characteristics of the procedure are listed: (1) It is applicable in early equipment-design stages when design changes, which may have to be made to reduce the manpower and training burden in terms of numbers of personnel and levels of training, are less costly and easier to make. (2) It provides a positive means for reducing maintenance manpower and training requirements. (3) It provides a relatively simplified technique that can be effectively implemented. (4) It is adaptable to automatic-data-processing techniques. P.V.E.

N64-22241 Innsbruck U. (Austria) Institut für Experimentelle Psychologie
COLOR DISCRIMINATION WITHOUT CHROMATIC VISION Quarterly Technical Status Report, 1 Jan.–31 Mar. 1964
Anton Hajos Mar. 1964 14 p
(Contract DA-91-591-EUC-2917)
(QTSR-3)

The problem of interaction in the visual system is being investigated experimentally to determine the nature and extent of interocular transfer. The visual disturbances produced by wearing for a long time either a monocular 16° prismatic spectacle with the other eye completely occluded, or squint glasses consisting of two 12° crown glass prisms worn with the base to the temporal side are summarized as follows: (1) The aftereffects of rainbow-fringes seen by the prism eye do not transfer to the other eye. (2) Changes in the chromatic response characteristics of the transfer (occluded) eye are evident in the short wavelength (blue) rainbow-fringe, but these must be regarded as control effects. (3) The aftereffects of curvature and of visual direction displacement are completely transferred. M.P.G.

N64-22258 Joint Publications Research Service, Washington, D.C.
MAN IN SPACE FLIGHT
V. I. Yazdovskiy 16 Aug. 1963 19 p Transl. into ENGLISH of an Article from the Book "Nauka i Chelovechestvo" Moscow, 1962 p 348–358, 408–410
(JPRS-20673; OTS-63-31545) OTS: $0.50

A human being in space encounters a large number of environmental factors he has never met on earth—the physical conditions of space, conditions in the spacecraft, and conditions resulting from prolonged flight. This article surveys some of the effects in those categories on Soviet cosmonauts. Also included is a brief history of Russian space efforts, the selection of cosmonaut candidates, and their training. Certain general scientific observations are made, based on space-flight data. G.D.B.

N64-22267 Electronic Systems Div., Bedford, Mass. Decision Sciences Lab.
OPTIMAL STRATEGIES AND HUMAN BEHAVIOR IN FUNGUS-EATER GAME 4
Jun-ichi Nakahara and Masanao Toda Feb. 1964 65 p refs
(Contracts AF 19(628)-2450; AF 19(628)-2968; Grant NSF GS-114)
(ESD-TDR-64-237; AD-600823)

Fungus-eater games yield a class of sequential decision tasks that involve both means objects and end objects in a fairly realistic fashion. The optimal strategy for the fourth fungus-eater game, which depends upon the level of fungus storage, is derived, and the behavior of humans playing this game is reported. Author

N64-22432* Naval School of Aviation Medicine, Pensacola, Fla.
A COMPARISON OF THE SYMPTOMATOLOGY EXPERIENCED BY HEALTHY PERSONS AND SUBJECTS WITH LOSS OF LABYRINTHINE FUNCTION WHEN EXPOSED TO UNUSUAL PATTERNS OF CENTRIPETAL FORCE IN A COUNTER-ROTATING ROOM

Ashton Graybiel and Walter H. Johnson Repr. from Annals of Otol., Rhinol. and Laryngol., v. 72, no. 2, Jun. 1963 17 p refs Previously published as NASA-CR-55621; see N64-15347 07-14
(NASA Order R-47)
(NASA-CR-55621)

The experimental design involved the use of a counter-rotating room (CRR), 21 normal subjects, and 9 deaf subjects with bilateral labyrinthine defects (LD). The CRR permitted exposure of the subjects to linear accelerations without the complication of angular velocity. Experimental variables included the inertial force, and whether the head was fixed or moving. With head fixed and eyes closed, all subjects perceived the changing direction of the resultant force with respect to themselves as an illusion of rotation and the direction of the resultant force as a tilt from the vertical with respect to the earth or floor of the room. With the room lighted, it appeared to be tilted (the oculogravic illusion), and in this regard there were differences between the normal and the LD subjects. Some of the normal but none of the LD subjects experienced symptoms of motion sickness. This group difference was attributable to the auricular sensory organs. These differences are discussed under two headings, precipitating factors and predisposing factors. I.v.L.

N64-22433* Naval School of Aviation Medicine, Pensacola, Fla.
COMPENSATORY NYSTAGMUS CONDITIONED DURING ADAPTATION TO LIVING IN A ROTATING ROOM
Fred E. Guedry, Jr. and Ashton Graybiel Repr. from J. of Appl. Physiol., v. 17, no. 3, May 1962 p 398–404 refs
(NASA Order R-1)

Seven men were rotated at 5.4 rpm in a room for 64 hr. Controlled tests before and during this interval demonstrated that disorientation and nystagmus attributable to Coriolis acceleration effects diminished markedly. A compensatory nystagmus, induced by heat or whole-body movements, was recorded more than 1 hr after the rotation had ceased. Factors of possible significance in conditioning the compensatory nystagmus are as follows: (1) otolith and proprioceptor sensory influx prior to and during discordant canal input; (2) a consistent sensory influx for each stimulus-producing movement; (3) intention in stimulus-producing movements; and (4) visual inhibition. Contributions of compensatory and arousal factors to vestibular suppression are considered in relation to practical problems of transfer of habituation from one acceleration environment to another. Author

N64-22434* San Jose State Coll. Foundation, Calif.
CONTRIBUTING FACTORS IN THE PERCEPTION OF THE OCULOGRAVIC ILLUSION
Brant Clark and Ashton Graybiel (Naval School of Aviation Med.) Repr. from the Am. J. of Psychol., v. 76, Mar. 1963 p 18–27 refs
(NASA Order R-1)

This is a study of the effect of an antecedent visual frame of reference on the perception of the horizontal when the direction and magnitude of the gravitational force acting on the body were changed. Initial static measures of the perceived horizontal were made with the experimental room stationary. Deviations of the perception of the horizontal from these static measures were determined as a function of time after exposure to a visual framework while the room was rotating to produce a change in magnitude and direction of resultant force acting on the *Os*; changes in the amount of the oculogravic illusion served as the criterion of change in the perception of the horizontal. The experiment consisted of observations following prolonged exposure to a visual framework and observations following varied short exposures. The deviation of the perceived horizontal from the static line-of-subjective-horizontal increased fairly rapidly up to about 60 sec, and more slowly for an equal time thereafter, true of both long and short exposures. No consistent, systematic differences were observed between exposure time from 1 sec to 2 min. The results show a gradual, though not a simple, continuous change in the frame of reference from visual to gravitational cues, in sharp contrast with the change from a gravitational to a visual framework that occurs very quickly. Author

N64-22437* Naval School of Aviation Medicine, Pensacola, Fla.
RORSCHACH INDICATIONS OF EMOTIONAL INSTABILITY AND SUSCEPTIBILITY TO MOTION SICKNESS
Allen E. Mc Michael and Ashton Graybiel Repr. from Aerospace Med., v. 34, no. 11, Nov. 1963 p 997–1000 refs Presented at the Annual Meeting, Aerospace Medical Assoc., Los Angeles, 30 Apr. 1963
(NASA Order R-47)

Individuals having a high rigidity factor in their personality, as measured by the Rorschach test, seem to be more susceptible to motion sickness than those who are less rigid. Nine subjects were administered psychological tests and exposed to aerial acrobatics, going to sea in a power boat, experiencing 0 g, and the slow rotation room. Anxiety, dependency, drive, lability, and rigidity were correlated to the experimental conditions. G.D.B.

N64-22438* San Jose State Coll. Foundation, Calif.
PERCEPTION OF THE POSTURAL VERTICAL IN NORMALS AND SUBJECTS WITH LABYRINTHINE DEFECTS
Brant Clark and Ashton Graybiel (Naval School of Aviation Med.) Repr. from J. of Exptl. Psychol., v. 65, no. 5, 1963 p 490–494 refs
(NASA Order R-37)

Nine normal men and ten men with vestibular defects were studied in a lateral tilt chair to determine their ability to set themselves in the postural vertical position in the absence of a visual framework. The data show that with practice there is a reduction in the median error in setting the chair to the postural vertical for both groups. The normal subjects exhibited smaller average errors; however, the differences were small, particularly after 15 trials, and were not statistically significant. M.P.G.

N64-22470* Naval Medical Research Inst., Bethesda, Md.
[BASIC PHYSIOLOGICAL MECHANISMS WHICH DEFEND THE HUMAN BODY AGAINST HEAT AND COLD] Quarterly Progress Report, 1 Jan. – 31 Mar. 1964
Lutz Kiesow [1964] 3 p
(NASA Order R-38)
(NASA-CR-56293) OTS: $1.10 ph

Work was carried out in the development of methods to obtain control of internal body temperature, without the necessity of applying a temperature sensor directly to the body. A system was proposed in which the physiologic central warm-sensor could operate as the main link of a manmade control loop in a spacesuit. Also discussed is the reason why formation or reduced diphosphopyridine-nucleotide is achieved simultaneously with the oxidation of nitrite to nitrate, only when in a coupled, driving reaction electrons are transferred, through a cytochrome-chain, to terminal acceptance by molecular oxygen. P.V.E.

N64-22515 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio Behavioral Sciences Lab.
ENGINEERING PSYCHOLOGY, TRAINING PSYCHOLOGY, ENVIRONMENTAL STRESS, SIMULATION TECHNIQUES, AND PHYSICAL ANTHROPOLOGY: A BIBLIOGRAPHY OF REPORTS, April 1946–March 1964
Lavon E. Trygg and Lucille E. Kelsey, comp. Apr. 1964 89 p refs
(AD-600804)

N64-22518 Sheffield U. (Gt. Brit.)
THE USE OF CUING IN TRAINING TASKS Technical Report
J. Annett and J. K. Clarkson Port Washington, N.Y., Apr. 1964 53 p refs
(Contract N62558-3143)
(NAVTRADEVCEN-3143-1; AD-601352)

In this study, five different methods of training for a simple auditory detection task were compared. The methods all represent different means of providing the trainee monitor with supplementary information about the input signals and/or the adequacy of his responses. The first method, called cuing, proved superior. The third method, knowledge of results, although the paradigm for motor response learning, was less effective in this perceptual task. In general, the trainee needs extra information about the signal rather than about his response to it. Differences in training methods show up particularly in the rate at which commissive errors (false positive responses) are made. Some tentative conclusions are drawn on the nature of perceptual learning and the vigilance decrement suggesting further research that could lead to improved training for detection tasks. Author

N64-22557 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INFORMATION PROCESSING IN A COMPLEX TASK UNDER SPEED STRESS Final Report
Alexander Z. Weisz and Linda S. Mc Elroy Bedford, Mass., Electronic Systems Div., May 1964 44 p refs
(Contract AF 19(604)-8449)
(Rept.-1129; ESD-TDR-64-391; AD-601379)

Differential effects of speed stress were sought in a complex task including five information processing activities differing in spatial and temporal uncertainty of events requiring response, location in display channels varying in frequency of occurrence of response events, short-term memory requirements, and perceptual requirements in event recognition. Highly practiced *Ss* were found to have evolved a priority strategy based primarily on frequency of response events in different display locations. High-frequency tasks not requiring search were relatively impervious to stress effects. Lower frequency events occurring in low-priority display locations gave rise to poorer performance at all levels of stress. Significant performance decrement under stress occurred first in the most complex low-probability task, which required search and short-term memory. Author

N64-22586 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio Behavioral Sciences Lab.
PREDICTING THE DIFFICULTY OF LOCATING TARGETS FROM JUDGMENTS OF IMAGE CHARACTERISTICS
Fen Rhodes Mar. 1964 57 p refs
(AMRL-TDR-64-19; AD-601375)

Judgments of 12 characteristics of 200 aerial reconnaissance photographs, each containing a designated target, and physical measures of target size and location were related to search time required to locate targets and to judged overall target difficulty. Twenty photointerpreters and 20 college students served as subjects. Photographs were divided into two equal groups to permit cross validation of results. A factor analysis of the data, including the two criterion measures, resulted in the extraction of eight orthogonal factors: (1) target size; (2) picture sharpness and contrast; (3) picture detail; (4) logical restrictions on possible target location; (5) target shape and pattern; (6) target location; (7) target isolation; and (8) rater bias. Raters were able to make highly reliable and seemingly valid judgments about complex perceptual characteristics of aerial photographs. There was no difference in reliability or validity between ratings made by photointerpreters and those made by untrained students. Author

N64-22567 Tufts U., Medford, Mass.
BELIEF STATES: A PRELIMINARY EMPIRICAL STUDY
Thornton B. Roby Bedford, Mass., Electronic Systems Div., Mar. 1964 42 p ref
(Contract AF 19(628)2450; Grant NSF G-10947)
(ESD-TDR-64-238; AD-600441)

The belief state, as a technique for describing beliefs, attitudes, and judgments, is proposed here as an important adjunct to psychological research, especially in the areas of decision making by individuals and by groups. The belief state is defined as a device for representing in probabilistic form an exact quantitative description of the information or beliefs an individual has about possible alternative conditions of the external world. The present study investigates the feasibility of measuring belief states in a simple laboratory situation, and of ascertaining by various statistical tests the degree to which these empirical measures conform to the normative standard of a perfect Bayesian calculation. It is shown that subjects in general depart from the standard in certain properties; that there are reliable individual differences among a subject's belief state measures as an apparent result of increasing experience with the task. Several suggestions are offered for future investigations of these measures under more closely controlled conditions. Author

15 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; sensors and transducers; and telescopes and cameras. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N64-21508 Naval Ordnance Test Station, China Lake, Calif.
VIBRATION STUDIES FOR JET FIGHTER AND ATTACK BOMBER AIRCRAFT INSTRUMENTATION
Howard C. Schafer Feb. 1963 8 p refs
(NOTS-TP-3026; AD-297924)

Data on the total vibration environment of the instrumentation of four Air Force century-series fighters and two Navy carrier-type jet-fighter or light attack-bomber aircraft are reviewed. These data are combined to represent a composite aircraft for the study of the vibration environment of instrument sensors and indicators for aircraft in these categories. The location zones of the instrument modules in the aircraft are taken into account, and vibration levels with respect to particular zones are discussed. Author

N64-21572 Fairchild Camera and Instrument Corp., Syosset, N.Y.

HELICOPTER MAIN ROTOR BLADE TRACKING DEVICE, DEVICE 9U96 Final Engineering Report, Jun. 1960–Sep. 1962

R. Sansone Feb. 1964 76 p

(Contract Nonr-1767(00))

(NAVTRADEVCEN-9U96-2; AD-436273)

This report describes the design, development, and testing of a helicopter main-rotor-blade tracking device. In its final configuration, device 9U96 consisted of a hand-held viewer and its attendant power supply and five corner cube wing-tip reflectors of different colors. The device was used to measure the out-of-track of the main rotor blades of an H-37B aircraft. It was found that device 9U96 was capable of measuring individual out-of-track to less than 1/4 of an inch at the blade cap at night. Testing during the day revealed that the device did not have full 24-hour capability. Author

N64-21796 Lund U. (Sweden) Thermochemistry Lab.

DESIGN, CONSTRUCTION AND TESTING OF A HEAT OF VAPORIZATION CALORIMETER USEFUL IN THE VAPOR PRESSURE RANGE 1 TO 0.001 (0.0001)mm Hg AT 25°C Final Technical Report No. 1, Jan. 1, 1963–Jan. 1, 1964

31 Jan. 1964 13 p

(Contract DA-91-591-EUC-2782)

(QI-360330-B; AD-434260)

A microcalorimeter was built for determining heats of vaporization of substances in the vapor pressure range 1 to 10^{-3} to 10^{-4} mm Hg. The calorimeter consists of a Knudsen-cell from which the substance is evaporated directly into high-vacuum space. Special care was taken to ascertain isothermal working conditions and to prevent contamination of the vacuum system by vapors, harmful increase of pressure due to the presence of vapor outside the calorimeter, and heat leak errors. The system was partly checked, and final testing and preliminary measurements are currently underway. Author

N64-21839 Picatinny Arsenal, Dover, N.J. Ammunition Engineering Directorate

RF ATTENUATION MEASURING TECHNIQUES

Frederick M. Correll Mar. 1964 111 p refs

(TM-1259; AD-433742)

An easily set up measuring system capable of ascertaining attenuation values up to 40 db in the frequency range from 40 mc to 10Gc is described in detail. This study also describes the necessity for measuring attenuation. Author

N64-21848 Boeing Co., Seattle, Wash.

A STUDY OF PHOTOINTERPRETER PERFORMANCE IN CHANGE DISCRIMINATION

C. L. Klingberg, C. L. Kraft, and C. L. Elworth Nov. 1963 168 p refs

(Contract AF 30(602)-2698)

(RADC-TR-63-482; AD-431495)

Two methods of inspecting pairs of comparison photographs were studied: side-by-side display, and apparent-motion display, in which pictures in spatial registry were presented in temporal alternation. This second presentation method produces apparent motion, where a difference between the pictures exists, which aids in the rapid detection of objects that have changed. Both experienced and inexperienced interpreters were tested with aerial photography varying in scale, contrast, resolution, and terrain complexity. Under certain conditions, the apparent-motion display method significantly enhanced interpreter performance in the change detection task. However, it became less effective with poorer quality imagery or where there was a high percentage of irrelevant change. Under difficult conditions, neither display method was significantly better than the other. Although the applications of the apparent-motion technique are limited, the results of this study suggest the value of further efforts to define the extent of its usefulness. Author

N64-21872 Cutler-Hammer, Inc., Deer Park, N.Y. Airborne Instruments Lab.

SOLID-STATE FERROELECTRIC ACCELEROMETER Interim Report No. 1, 4 Nov. 1963–4 Feb. 1964

M. L. Wright and M. M. Freundlich 26 Feb. 1964 16 p

(Contract NOw-64-0093-C)

(AD-432049)

Various promising plastic and crystalline materials were collected, and a fixture for testing the materials was built. The design of a suitable sample holder has been started for a fringe-counting readout system. A coherent-light digital-readout system was investigated, and the inherent advantages of this system are discussed. Author

N64-21933 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

HEXAMEMBRANE PRESSURE SENSING ELEMENT

M. B. Mayzel' 25 Jul. 1963 3 p refs Transl. into ENGLISH from Priborostroenie (Moscow), no. 12, 1962 p 24

(FTD-TT-63-654/1+2; AD-415139)

A multimembrane pressure sensing element designed to amplify signal output is described. There are six membranes in the element. A measuring bridge is glued over each one. For identical membranes, during the adding of imbalance signals from several measuring bridges, the total sensitivity of the sensing elements is equal to the sensitivity product of one membrane element per number of elements. The advantage of the described sensing element is that the rise in sensitivity is accompanied by a reduction in relative value of measurement errors. R.T.K.

N64-21943 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A RADIATION THERMOMETER

I. D. Semikin 10 May 1963 20 p refs Transl. into ENGLISH from Avtomatiz. i Priborostr., Inst. Avtomatiki Gosplana UkSSR, Sb. Nauchn. Trudov (Kiev), no. 2, 1961 p 153–164

(FTD-TT-63-64/1+2; AD-409749)

A device for automatically controlling and regulating the temperature of a furnace used in metal annealing is described. The active principle of the device (radiation thermometer) is the measurement of a temperature drop induced in a heat resistor, by a heat flow that a heat receptor receives from the emitter (furnace). The heat receptor is an ideal black body (an opaque hollow body), and rays from the emitter are passed through a small hole in the black body. The temperature drop between the black body and a constant-temperature heat sink is measured, and the heat flow is calculated. P.V.E.

N64-21957 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

SOME PROBLEMS OF AERIAL PHOTOGRAMMETRY WITH COLOR AND SPECTROZONAL PHOTOGRAPHIC MATERIALS

A. N. Uspenskiy 29 Oct. 1963 9 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 5, 1958 p 42–45

(FTD-TT-63-827/1; AD-425667)

Aerial photogrammetry on color and spectrozonal film is being accomplished with photo equipment designed for black and white film. The problems this creates are discussed, and some practical solutions are presented. G.D.B.

N64-21963 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CIRCUMFERENTIAL VERTICAL PERSPECTIVE AERIAL CAMERA

A. V. Bushuyev 24 Mar. 1964 6 p Transl. into ENGLISH from Soviet Patent No. 134930, 12 Apr. 1960 p 1–3
(FTD-TT-63-1004/1+2+4; AD-439597)

The circumferential, vertical, perspective aerial camera makes it possible, with one aerial shot, to include a larger area than can the conventional cameras. It is equipped with two objectives—one gives the vertical image, and the second, with the help of a double-image prism, gives a perspective image of the terrain. The circumferential, vertical, perspective aerial camera is different also because of the diaphragm that has a rotating segmented sagittal aperture. N.E.A.

N64-21964 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

AN OPTICAL DEVICE WHICH COMPENSATES FOR LINEAR SHIFT IN PANORAMIC STRIP AERIAL PHOTOGRAPHY WITH HORIZONTAL SCANNING AXIS

I. V. Kal'berg and Yu. K. Yutsevich 24 Mar. 1964 5 p Transl. into ENGLISH from Soviet Patent no. 132951, 15 Feb. 1960 p 1–3
(FTD-TT-63-1005/1+2+4; AD-600122)

Conventional optical devices that compensate for linear shift in panoramic, strip aerial photography are described, and it is noted that they are designed for photography only at constant image velocity. A device is described that eliminates this disadvantage by use of a rotating compensator in front of the objective and with the same speed as the projected pencil of rays. Two drawings are included. D.E.W.

N64-21967 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A THICKNESS MONITOR FOR THIN FILMS OBTAINED BY VACUUM SPRAYING

A. A. Korsunskiy and I. G. Razumnov 7 Aug. 1963 21 p Transl. into ENGLISH from the Book "Indikator Tolshchiny Tonkikh Sloyev, Poluchayemykh Metodom Vakuumnogo Raspyleniya Materialov" Moscow, Inst. Tochnoy Mekhan i Vychislitel' noy Tekhn. Akad. Nauk SSSR. 1960 p 1–14
(FTD-TT-62-1863/1+2+4; AD-421460)

Described is a device that allows the monitoring of the thicknesses, not more than 2×10^4 to 3×10^4 A, of thin films of a practically unrestricted class of materials obtained by vacuum spraying. Knowledge of the substances to be sprayed is sufficient to carry out the calibration for just one material. Author

N64-22000 General Electric Co., Lynn, Mass. Instrument Dept.

DEVELOPMENT OF AN IMPROVED TIME-TEMPERATURE INTEGRATOR Final Report

J. H. Thomson Feb. 1964 83 p refs
(Contract NOw-63-0622F)
(AD-434147)

The time–temperature integrators incorporate sensing elements made of alternate roll-bonded layers of palladium and platinum foils. The mutual solid-state diffusion that occurs between these two metals is related to temperature and causes a change in the electrical conductivity of the sensing element. If this time–temperature integrating property of the sensing element could be related to jet engine life, the device could be used as a means of checking engine deterioration. The problems encountered in producing the time–temperature integrators are discussed, and the difficulties associated with the application of the integrators to jet engines are pointed out, making further research unwarranted. Author

N64-22010 Brazil Comissao Nacional de Atividades Espaciais, Sao Paulo

ABSORPTION MEASUREMENTS WITH RIOMETER DATA SUMMARY FOR THE PERIOD MARCH THROUGH AUGUST, 1963

M. A. Sette and F. de Mendonca Dec. 1963 22 p refs Jointly prepared with Stanford Res. Inst. and AFCRL
(LAFE-9)

A catalog of reduced riometer data obtained during the initial period of observations from March 16 through August 31, 1963, is presented. For each month, the value of absorption is tabulated for the first minute of each hour to the nearest 0.05 db, and the total number of readings for the month as well as the median value are indicated in the same table. Also shown are the following: (1) a "quiet-day" curve for the station that was obtained from the available data of the period; (2) a listing of the registered solar flares and related absorption effects during the period; and (3) a record in which the effect associated with a solar flare on the cosmic-noise absorption is quite evident. P.V.E.

N64-22040 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE UNIVERSAL MEASURING MICROSCOPE, UIM-23

27 Feb. 1964 5 p Transl. into ENGLISH from the Publ. "Universal'nyy Izmeritel'nyy Mikroskop Uim-23" Leningr. Ekon. Administrativnyy Rayon, 1962 2 p
(FTD-TT-64-7/1+2; AD-433582)

The Universal Measuring Microscope, UIM-23, is intended for the linear and angular measurement of a variety of objects within rectangular and polar coordinates, including smooth and threaded gages, cones, cams, profiled templates, and scales, as well as for the measurement of objects having small openings. The device can have wide application in the measuring laboratories of factories and scientific-research institutes of the machine-building industry. This microscope consists of a sturdy base, measuring carriages (longitudinal and transverse), a sight system with adapter, and an illumination unit. The measuring carriages of the device are transported on ball bearings along precise guides in two mutually perpendicular directions. In the measuring process, the image of the measured piece, which is in the visual field of a projected or binocular setting, is observed, and by specific movements of the carriages, a sighting of the dash lines on the screen of the viewing system is produced. Readings of the transported carriages are produced on fine millimeter scales, with the aid of the reading projection units. I.v.L.

N64-22055 General Electric Co., Cincinnati, Ohio Advanced Technology Services

REACTOR INSTRUMENTATION AND CONTROL PROGRESS REPORT NO. 82, 1 MAR. - 30 APR. 1964

May 1964 23 p refs
(Contract AT(40-1)-2847)
(GEMP-82) OTS: $0.50

A beryllia sensor was fabricated and then tested at temperatures up to 2,220° C in a nonoxidizing atmosphere. A single crystal alumina sensor element for use with a 1,650° C-oxidizing atmosphere system was also fabricated and tested. Vacuum seal testing and evaluation for application in fission counters to 816° C and in d.c. ionization chambers to 538° C were continued. Life testing of sensor assemblies at 816° C continued. Several different designs of a fail-safe shutdown channel using an a.c. ionization chamber were investigated. The most promising of these were set up and tested. The investigation of anodized coatings to retard low-energy secondary electrons and improve the performance of charged-fragment neutron detectors was

continued. The use of a magnetic field to stop the low-energy secondary electrons was also investigated. R.T.K.

N64-22081 Aberdeen Proving Ground, Md. Ballistic Research Labs.

A PULSE OPERATED SHUTTER SYSTEM FOR AN AERIAL CAMERA WITH CELESTIAL ORIENTATION

Richard G. Reitz Oct. 1963 32 p ref
(BRL-MEMO-1533; AD-433779)

A pulse-operated shutter system was developed for use with an aerial camera with celestial orientation. The shutter system provides for synchronization of a celestial and a terrestrial photograph to within 0.001 second of one another. Exposure durations of 0.010, 0.005, 0.003, and 0.002 second are available. Author

N64-22145 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MAGNETOMETER

N. N. Zatsepin 28 Mar. 1963 4 p Transl. into ENGLISH from Soviet Patent no. 144546, 12 Aug. 1960 p 1–3
(FTD-TT-62-1874/1+2; AD-402446)

The sensitivity of magnetometers ordinarily used depends on the magnetic penetrability of the body (form) of the core of the element. In magnetic defectoscopy, geophysics, etc. the necessity often arises for measuring an essentially nonuniform magnetic field. The peculiarity of measuring such a field stems from the fact that weak magnetic fields distort the real topography of the field. To solve this problem a magnetometer was designed as a type of magnetic probe. It consists of a rectangular rod of material with great initial magnetic penetrability and is provided with a magnetizing a.c. winding. In order to increase the sensitivity of the magnetometer, a probe, which is made of a magnetodielectric and is provided with a measuring coil, is included in the central rod of the closed three-rod core. J.L.D.

N64-22152 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

MEASUREMENT OF LINEAR ACCELERATIONS

N. P. Rayevskiy and M. I. Subbotin 7 Mar. 1963 77 p refs Transl. into ENGLISH of the Publ. "Izmereniye Lineynykh Uskoreniy" Moscow, Izd. Akad. Nauk SSSR, 1961 p 1–62
(FTD-TT-62-860/1+2; AD-400524)

The characteristic nature of acceleration measurements and descriptions of accelerometers based on the use of various mehods of measurements are presented in the following: (1) measurement of maximum values of acceleration; (2) apparatus for measuring maximum accelerations; (3) fundamentals of the theory of accelerometer constants; (4) design of accelerometers; (5) experimental determination of accelerometer constants; (6) sensors for linear acceleration with inertial elements; (7) measurements of impact accelerations; (8) sensors for measurements of impact acceleration; and (9) calibration of impact accelerometers. N.E.A.

N64-22167 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

TESTING OF FLOATED GYROSCOPES

G. A. Slomyanskiy 8 Mar. 1963 48 p refs Transl. into ENGLISH from Voprosy Tekhnologii Proborostroyeniya, Aviatsionniy Tekhnologicheskiy Institut (Moscow), no. 40, 1959 p 21–54
(FTD-TT-62-1230/1+2; AD-299675)

A description and operating principles of a rotating apparatus, single-axis integrators or integrating drives, used in testing floated gyroscopes are presented. N.E.A.

N64-22216 Tokyo U. (Japan) Inst. of Industrial Science

SOME APPLICATIONS OF PHOTOGRAMMETRY TO PRECISION MEASUREMENT OF SCULPTURES

Takakazu Maruyasu and Taichi Oshima Mar. 1964 39 p refs *its* Rept., v. 13, no. 7 (Serial no. 94)

This paper deals with the problems of short-range photogrammetry beyond the sphere of conventional geodetic surveying, and describes the manner in which these were overcome during the course of studies pertaining to the 13th century bronze statue of Amida Nyorai of Kamakura and the 9th century cave statues of Oya. N.E.A.

N64-22221 General Electric Co., Philadelphia, Pa. Missile and Space Div.

PERFORMANCE EVALUATION OF TRAP IMAGE ORTHICON SYSTEM

R. L. Gulatsi 21 Dec. 1963 34 p
(Contract AF 04(694)-222)
(R63SA1042; AD-433621)

Presented is a description of the image orthicon system, along with data derived from experiments performed to investigate system performance achievable in a point target radiometric application. Presently achievable performance provides a best sensitivity of about 2×10^{-14} watts/cm^2-S10. Maximum point target resolution was 250 elements, occurring at or near the minimum input signal level. Blooming decreases resolution of about 180 to 100 elements, depending on system adjustment, at the upper end of the dynamic range. Dynamic ranges of about 20 to 60 were measured, dependent on the system operation mode in use. Capability for operation at integration times of less than one frame was established, along with the indication that reciprocity should hold reasonably well under this condition. It was noted that the system exhibits an overall gain drift. This causes, for a fixed input irradiance, a change by a factor of up to about 1.5 in output video pulse amplitude over a 5- to 10- minute period. P.V.E.

N64-22227 Aeronutronic, Newport Beach, Calif.

SPACE AND ELECTRONIC PROGRAMS. VOLUME II: ALTIMETER STUDY FOR THE RANGER LANDING SYSTEM Final Report

J. F. Mc Carty 30 Oct. 1963 46 p refs Prepared for Northrop Corp.
(U-2252)

The functional characteristics and performance capabilities of the Ranger Landing System Altimeter are reviewed in order to verify its applicability to future lunar missions and to define the altimeter accuracy capability under diverse mission profiles. The results of the altimeter study are used to establish an estimate of altimeter subsystem-error contribution to the overall landing system dispersion. It is concluded that the effect of system errors not intrinsic to the altimeter is such that neither isotropic- nor narrow-beam mechanization is able to perform the fuzing function with accuracy beyond 15° off-normal approach. The narrow-beam altimeter fuzing on slant range is significantly superior to any other system due to elimination of the error from approach-angle uncertainty. M.P.G.

N64-22249 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

AN A.C. BRIDGE FOR CURRENT GAIN MEASUREMENT OF TRANSISTORS AT MICRO-AMPERE COLLECTOR CURRENTS

G. E. Burton Nov. 1963 12 p
(RAE-TM-SPACE-27)

The instrument measures current gains of both npn and pnp transistors with 2% accuracy at collector working currents

between 1 μA and 2 mA and collector voltages between 0 and 6 volts. The current gain, beta, is indicated directly on a dial with two linear scales: 0 to 140 and 140 to 280. Calibration is simple and requires no additional equipment. The monitoring of signals is unnecessary, since precautions against overloading have been built in. The instrument is easy to operate, and full meter protection is provided. The whole unit is powered by two 6-v dry cells, and the total consumption is 120 mw. Author

N64-22272 Air Force Systems Command, Eglin AFB, Fla. Research and Technology Div.
ENVIRONMENTAL EVALUATION OF THE MODULATED CARRIER WAVE, TUMBLING-AIRFOIL, CRASH POSITION INDICATOR
V. L. Reierson Apr. 1964 41 p
(ATL-TDR-64-20; AD-600053)

Laboratory environmental tests included low and high temperature, high altitude, humidity, salt spray, vibration, shock, and life tests. Temperatures from −54° to +65° C, and simulated altitudes to 80,000 ft were used. The beacon survived all tests without permanent deterioration or damage. Temporary deterioration of beacon performance did occur at extremely low temperatures; however, beacon performance recovered completely at ambient temperature. The beacon was tested at and is considered acceptable for storage from −54° to +65° C to 80,000 ft and for operation from −35° to +65° C at altitudes to 50,000 ft under the humidity, salt spray, vibration, and shock impact conditions specified. Author

N64-22273 Xerox, Rochester, N.Y.
RESEARCH ON PHOTOCONDUCTOR IMAGING WITH THERMOPLASTIC STORAGE
J. T. Bickmore, C. J. Claus, M. J. Lenhard, W. P. Mann, and H. Neyhart Wright-Patterson AFB, Ohio, AF Avionics Lab., Apr. 1964 204 p refs
(Contract AF 33(657)-8814)
(RL-64-6; AL-TDR-64-41; AD-440391)

An investigation was made of a new photographic method in which an electrostatic latent image is transferred to a thermoplastic film and then heated to create a deformation image. A camera-developer device was constructed for studies of the charge-transfer frost-type photographic system. A panchromatic photoreceptor was utilized that consisted of a conductive glass substrate overcoated first with a thin selenium–tellurium alloy and then with a thicker selenium layer. Materials were investigated for the frostable layer and for the charge-transfer liquid; these characteristics were determined separately and together. R.T.K.

N64-22351 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVICE FOR MEASURING TEMPERATURE COEFFICIENTS OF SMALL MAGNETS
V. N. Bobrov 22 May 1963 7 p Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 2, 1962 p 550–552 refs
(FTD-TT-63-423/1+2+4; AD-409562)

A device for the rapid measurement of temperature coefficients of small magnets ($\mu \geq 10^{-8}$) is described. The basis of the device is a quartz sensing element enclosed in an airtight housing. A magnet with a magnetic moment of less than 0.5 cgs is used as the suspension system of the sensing element. The suspension system is adjusted by delicate untwisted threads in a zero magnetic field. The housing with the sensing element is fastened to a clamp rigidly secured to a flat disk base with three adjustment screws. On the clamp below the housing, a rotating rod with a magnet is fastened. This serves to change the scale division of the sensing element. Above the housing, a rod with a comagnet is rigidly fastened. This is used when it is necessary to change the field at the center of the sensing element. The magnet to be investigated is placed between two rods of a carriage that runs along a busbar. The scale division of the sensing element is determined by means of a rotatable magnet with a known magnetic moment. The technique of measuring with this device is discussed. I.v.L.

N64-22355 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WIRE-RESISTANCE STRAIN GAGES AND THEIR APPLICATION
A. M. Turichin and P. V. Novitskiy 20 Jan. 1964 241 p refs Transl. into ENGLISH from the book "Provolochnyye Preobrazovateli i. Ikh Tekhnicheskoye Primeneniye" Moscow, Gos. Energ. Izd., 1957 p 1–171
(FTD-TT-63-729/1+2+4; AD-600040)

The theory, construction, and practical application of wire-resistance strain gages are discussed. The following areas are covered: (1) basic components of a wire-resistance strain-gage device, and two ways of using wire-resistance strain gages; (2) wire-resistance strain-gage grids; (3) attachment of strain-gage grids to parts under test; (4) properties of wire-resistance strain gages; (5) measurement of mechanical quantities, using strain gages mounted directly on the part under test; (6) measurement of mechanical quantities, using resistance strain gages with a flexible element; (7) measuring circuits of instruments, using resistance strain gages; and (8) errors and calibration of strain-gage instruments. R.T.K.

N64-22396 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHODS OF MEASURING THE ROUGHNESS OF A WORKED SURFACE
A. L. Markov and F. P. Volosevich 1 Mar. 1963 18 p refs Transl. into ENGLISH from Chapter XI of the Book "Kratkiy Spravochnik Kontrol'nogo Mastera Mashinostroitel'nogo Zavoda" Moscow, Mashgiz, 1961 p 206–218
(FTD-TT-62-1757/1+2; AD-400532)

Definitions and general information on determining the quality of a metal surface are presented to clarify a new set of state standards for the roughness of worked surfaces. A distinguishing feature of the standards is a new criteria for assessing the finish—the mean arithmetic deviation of the profile R_a and the height of the microirregularities R_z. Inspection methods and measuring apparatus are also discussed. M.P.G.

N64-22403 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A METHOD OF THERMOMAGNETIC PULSE MODULATION AND A DEVICE FOR ITS REALIZATION
A. S. Dadunashvili 4 Feb. 1960 6 p Transl. into ENGLISH from Soviet Patent no. 130071, 1 Jun. 1959 1 p
(FTD-TT-62-1805/1+2+4; AD-299637)

A method is proposed to increase the efficiency and reliability of the operation of a thermomagnetic pulse-modulation device. This is accomplished by using a composite core with windings. In order to modulate the high-frequency currents, a core made of ferromagnetic semiconductors, on which a short-circuited coil or sleeve is located, is used to heat the composite core. Continuous alternating pulses are obtained in two different circuits by use of a third bar having two windings on it and located in the composite core. R.T.K.

N64-22450* Radiation Technology, Inc., Atlanta, Ga.
THE DESIGN, MANUFACTURE AND TEST OF COX FLOWMETERS Final Report
W. R. Champion May 1964 26 p
(Contract NAS8-5220)
(NASA-CR-56446) OTS: $2.60 ph

Described is work carried out to modify the design of a gaseous-oxygen flowmeter to new environmental and performance specifications, and to fabricate and test 25 engineering models of the new design. The new models are to operate from 28-v d.c., to include incorporation of gain adjustments, to have heater and insulation sufficient to allow operation to −155° C, and to have a maximum range of 1,500 cc/min. P.V.E.

N64-22457 Oklahoma U. Research Inst., Norman
MICROWAVE POWER LEVELER FOR K BAND
Edgar A. Rinehart and Robert L. Legan Repr. from Rev. Sci. Instr., v. 35, no. 1, Jan. 1964 p 103–104 ref
(Contract Nonr-982(07))
(TR-9; AD-434011)

A device was developed for regulating milliwatts of microwave power in the 24-kmc region. The power leveler operated over the electronic sweep range of a K-band reflex klystron, and regulated power to within ±0.5%. Author

N64-22507 Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
ENERGY- AND RATE-DEPENDENCE STUDIES Final Report
R. K. Durkee, A. C. Lucas, N. B. York, T. S. Dahlstrom, and G. E. Blair [1963] 149 p refs
(Contract DA-49-186-ORD-1059)
(S-237-R; AD-429250)

Dosimeter systems of silver-activated phosphate glass rods, cobalt glass plates, and manganese-activated calcium fluoride were evaluated for their response to gamma rays, electrons, and neutrons. Response to gamma rays in the energy region from 0.022 to 15 Mev, rate dependence from 10 r/sec to 10^7 r/sec (in excess of 10^8 r/sec using 10 Mev electrons), and neutron sensitivity for fast and thermal neutrons were measured. Energy discriminatory shields and thermal neutron attenuation shields were designed, fabricated, and evaluated for each dosimetry system. Author

N64-22511 RCA Service Co., Inc., Patrick AFB, Fla.
STUDY OF EMULSION SHIFT ON BALLISTIC CAMERA PLATES
H. A. Starbird AF Missile Test Center, Jan. 1964 32 p refs
(Contract AF 08(606)-5300)
(TC-TDR-64-4; AD-600824)

Process treatments and emulsion batches were studied for their effect on the quantity of emulsion shift. Assignable linear vector shift of 0.4μ/cm was identified; the assignable random emulsion shift appears to be in the order of 0.7μ. The study indicated that the final rinse has the most significant process effect on both systematic and random shifts. The fixer, use or nonuse of a prehardener, different process runs and vertical vs horizontal drying had no identifiable significant effects. The emulsion batches demonstrated significant effects. The reading error continues to be the most significant factor in error of position determination. Author

N64-22520 Army Cold Regions Research and Engineering Lab., Hanover, N. H.
VISUAL RESOLUTION AND OPTICAL SCINTILLATION OVER SNOW, ICE, AND FROZEN GROUND. PART I
Donald J. Portman, Edward Ryznar, Floyd C. Elder, and Vincent E. Noble Apr. 1964 99 p refs
(Contract DA-11-190-ENG-78)
(RR-111; AD-600926)

The experimental results included estimates of the limit of visual resolution, telephotometer measurements of the apparent fluctuations in brightness (scintillation) of an artificial light source, and measurements of wind direction and of the vertical distributions of wind speed and temperature. The principal results of the analysis showed that, for turbulent flow in stable stratification over snow, visual resolution deteriorated systematically as scintillation increased in intensity, and scintillation intensity increased with increase in vertical temperature gradient. Scintillation was at a minimum in the absence of thermal stratification and at a maximum (in very stable thermal stratification) during the sudden transition from laminar to turbulent flow. For a given temperature gradient, scintillation increased with increase in wind speed. When wind and temperature gradients were combined in terms of the Richardson number and related to scintillation, the data obtained over snow indicated a critical Richardson number of about 0.35. Author

N64-22559 National Research Corp., Cambridge, Mass.
HIGH VACUUM MEASURING INSTRUMENTATION AND METHODOLOGY Technical Documentary Report, Dec. 1962–Mar. 1964
Jonathan R. Roehrig Wright-Patterson AFB, Ohio, AF Flight Dynamics Lab., Apr. 1964 112 p refs
(Contract AF 33(657)-10394)
(FDL-TDR-64-68; AD-601556)

This report is a detailed study of the principal high vacuum measuring instruments with a discussion of their applications and the many sources of error. A section is also included on the calibration of these measuring instruments. Author

N64-22653 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DEVICE FOR MEASURING AND RECORDING ATMOSPHERIC TURBULENCE
V. P. Belyayev and G. N. Shur 2 Aug. 1963 7 p Transl. into ENGLISH from Soviet Patent no. 152107(Appl. no. 755810/26–9) 14 Dec. 1961 p 1–3
(FTD-TT-63-623/1+2; AD-416776)

A device is described that can be used to obtain data on the turbulence of the atmosphere up to an altitude of 25 to 30 kilometers, with the aid of a radiosonde. The device separates continuous signals of turbulence data from a general background of coded signals. This separation is accomplished through the use of a meter that measures the ratio of the average pulse spacing to the average pulse duration. P.V.E.

N64-22656 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SCINTILLATION COUNTER FOR GAMMA DEFECTOSCOPY
30 Jul. 1963 3 p Transl. into ENGLISH from the Publ. Stsintillyatsionnyy Schetchik dlya Gamma-Defektoskopii (USSR) 1960 p 1
(FTD-TT-63-696/1; AD-417580)

The counter is to be used for contactless defectoscopy of various materials while in the process of being manufactured and can be used over a wide range of material thicknesses (0.05 to 500 mm). It can be used at temperatures up to 1,000° C and can detect internal defects in materials with unmachined surfaces, even when the surface irregularities exceed the dimensions of the defects. P.V.E.

N64-22657 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ION-SORPTION PUMP WITH COLD CATHODE
C. Kiliszek and W. Czarycki 6 Aug. 1963 7 p refs Transl. into ENGLISH from Przeglad Elektron. (Poland), no. 12, 1962 p 698–701
(FTD-TT-63-702/1+2; AD-419251)

An electron pump is described that consists of a cylindrical anode (plate) made of a nonmagnetic material (NiCr20 or CuNi45) and a cathode in the form of two plates each placed at a distance of about 2 mm from each end of the cathode and perpendicular to its axis. The cathode is made of pressed and calcined titanium; its surface has a great number of microroughnesses facilitating the emission of electrons. Between the cathodes, which are interconnected, and the anode is a voltage difference of several kv. In addition to calcined titanium cathodes, zirconium and tungsten cathodes were used. The rate of pumping of pumps with titanium and zirconium cathodes is almost identical. The pumping rate with tungsten cathodes was slightly lower than with the other two cathodes. P.V.E.

N64-22658 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WIND PROTECTION FOR RADIOSONDE BALLOONS
N. G. Durasov 2 Aug. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 152108 (Appl. no. 765832/26-10) 9 Feb. 1962 p 1–3
(FTD-TT-63-708/1+2; AD-416774)

A device to provide wind protection for radiosonde balloons during launching is described. During inflation and deflation the device is in the shape of an ellipsoid; its asymmetrical halves are constructed from metallic (e.g., duralumin) tubes bent in the form of an arc. The lower half of the ellipsoid has a thick elastic material stretched over it and is rigidly fastened to a collar that has an opening for the balloon to extend through. The upper half of the ellipsoid is covered with a thin material and is fastened, hinge fashion, to a similar collar. P.V.E.

N64-22677* National Aeronautics and Space Administration, Washington, D.C.
THE SPECTROSCOPIC METHOD OF INTEGRAL DETERMINATION OF THE WATER VAPOR CONTENT IN A COLUMN OF ATMOSPHERE [K VOPROSU O SPEKTROSKOPICHESKOM METODE INTEGRAL'NOGO OPREDELENIYA SODERZHANIYA VODYANOGO PARA V STOLBE ATMOSFERY]
I. Ya. Badinov, A. P. Gal'tsev, and G. A. Nikol'skiy Washington, NASA, Jun. 1964 17 p refs Transl. into ENGLISH from Probl. Fiz. Atm. Sb. 2, Izd. Leningr. Univ. (USSR) 1963 p 113–126
(NASA-TT-F-212) OTS: $0.50

A simple and inexpensive field instrument using a spectrographic method is discussed. The instrument operates on the principle of measuring the ratio of the intensities in two regions of the solar spectrum. One spectral region is selected in the absorption band of water vapor, and the other is chosen outside the band, but as close as possible to the first. Operation of the instrument is based on the compensation method of measurements; that is, equalizing two light fluxes that pass through two light filters and strike two identical detectors. Author

N64-22700 IIT Research Inst., Chicago, Ill. Technology Center
DEVELOPMENT OF A SOIL STRAIN GAGE FOR LABORATORY DYNAMIC TESTS Final Report, 1 Mar.–31 Dec. 1963
Robert W. Keller and Marvin E. Anderson Kirtland AFB, N. Mex., Res. and Technol. Div., Apr. 1964 43 p ref
(Contract AF 29(601)-5343)
(WL-TDR-64-7; AD-438826)

The new coil-plate gage can be operated with the same auxiliary electronics used with the four-coil gage. The gage consists of two bifilarly wound coils and two conducting plates and associated electronic instrumentation. One bifilar coil and plate is embedded in soil as the strain sensing element; the other coil and plate is externally positioned on an adjustable precision mount to serve as a reference. The principle of operation is that of a series adding transformer having its secondary connected to an open circuit-null balancing system to permit accurate measurements of small strains. Measurements can be made close to boundaries and to materials exhibiting magnetic properties. Author

N64-22723 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
EVALUATION OF CALIBRATION METHODS FOR IONIZATION GAUGES
Chr. Meinke and G. Reich 24 Mar. 1964 9 p refs Transl. into ENGLISH from Vakuum Tech. (Berlin), v. 11, no. 3, 1962 p 86–88
(RSIC-144; AD-436191)

A formula is derived that relates the degree of pressure reduction in a McLeod gage quantitatively to the flow rate of mercury vapor arising from the gage. By reducing the temperature of the mercury, the discrepancy between McLeod gage pressure and the true pressure prevailing in the system can be drastically reduced. There was satisfactory agreement between measured and actual pressure when the nature of the gas and the geometry of the piping was taken into consideration. P.V.E.

N64-22725 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
CALIBRATION MEASUREMENTS WITH A MCLEOD MANOMETER
E. O. Locherbach and F. J. Schittko 3 Apr. 1964 16 p refs Transl. into ENGLISH from Vakuum Tech. (Berlin), v. 11, no. 2, 1962 p 51-56
(RSIC-153; AD-436189)

Errors that may readily occur in McLeod manometer pressure measurements are discussed, and a test series is described for enabling the results of these measurements to be reliably correlated to a gas density value. I.v.L.

16 LIFE SCIENCES

Includes biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness. *For related information see*: 14 Human Behavior; and 28 Space Radiation.

N64-21501 Sharpley Labs., Inc., Fredericksburg, Va.
ELEMENTARY HYDROCARBON MICROBIOLOGY Final Report, 5 Feb. 1963–4 Mar. 1964
J. Miles Sharpley Wright-Paterson AFB, Ohio, AFSC, Apr. 1964 310 p refs
(Contract AF 33(657)-10865)
(ASD-TDR-63-752; AD-600232)

The solution to the problem of microbial deterioration of petroleum products is important because of the increased demand for higher quality materials. Because hydrocarbon

microbiology is an interdisciplinary science involving both petroleum technology and microbiology, this handbook was prepared to describe practical and theoretical aspects of hydrocarbon microbiology with specific emphasis on jet fuels. Areas covered include general microbiology, identification of microorganisms found in hydrocarbon systems, nutritional studies, microbial detection techniques, corrosion detection, investigation of biocides, physical protection systems, and current research efforts. Author

N64-21523 Air Force Special Weapons Center, Kirtland AFB, N. Mex. Research Directorate

PASSIVE DOSIMETRY ANALYSIS TECHNIQUES

Richard Griffith, Harry Murphy, and Donald Wood Jan. 1964 35 p refs

(AFSWC-TDR-62-107; AD-432686)

This report summarizes the techniques required to analyze standard neutron foil and gamma dosimetry. Levels of accuracy and the conditions under which they can be obtained are discussed. Techniques involve total gamma dose measurement, total neutron flux measurement, and determination of a six-group neutron-energy spectrum. Author

N64-21533 Institute for Research, State College, Pa.

LOGIC OF SYSTEMS. INTRODUCTION TO THE FORMAL THEORY OF STRUCTURE

Masanao Toda and Emir H. Shuford, Jr. Bedford, Mass., L. G. Hanscom Field, Electron. Systems Div., Jan. 1964 85 p

(Contract AF 19(628)-2968; Grants NSF GS-114; NSF G-24024)

(ESD-TDR-64-193; AD-432879) OTS: $8.10

Structure and purpose are two key aspects in the analysis and synthesis of complex systems. A full-fledged science of behavior must be based on a well-articulated formal theory of structure and purpose. Some of the basic notions in the formal theory of structure are introduced. Later papers will extend the theory of structure, introduce the formal theory of purpose, and investigate the relation between structure and purpose. Author

N64-21538* General Dynamics Corp., Groton, Conn. Electric Boat Div.

WASH WATER RECLAMATION FOR EXTENDED DURATION SPACE VOYAGES

Joseph A. Lubitz, Richard J. Benoit, Harold Wallman, and Thelma E. Adamson N.Y., AIAA [1964] 8 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964

(Contract NAS1-2208)

(AIAA Paper-64-212) AIAA: $0.50 members, $1.00 nonmembers

A study was conducted to determine the nature and concentration of impurities present in waste water resulting from personal bathing on a space flight of extended duration. Various washing compounds were evaluated, and benzalkonium chloride (BAC) was selected because of its detergent and germicidal properties. BAC is also nonvolatile, nontoxic, and nonirritating. Daily sponge bathing using four pints of a 1,000-ppm solution of BAC was practiced by two volunteers for several weeks. Laboratory loading tests on charcoal and ion exchange resins were carried out using the waste water to determine effectiveness in removing impurities such as urea and BAC. A multifilter unit was tested and found to be successful in purifying dirty wash water. Chemical, bacterial, and organoleptic results are given. A virus survival experiment was carried out using the multifilter system. The filter sysem completely removed virus added to the feed water. Author

N64-21544 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A MINIATURE RADIOTELEMETRIC APPARATUS FOR RECORDING PHYSIOLOGICAL FUNCTIONS

L. P. Shuvatov 26 Feb. 1964 10 p Transl. into ENGLISH from Elektron. V Med. (Moscow), 1960 p 177–182

(FTD-TT-63-1029/1+2+4; AD-433186)

The radio transmitting device of the apparatus consists of miniature sensors that transform into electrical signals the nonelectrical physiological quantities to be measured. The electrical signals control the operation of a miniature radio receiver weighing 50 to 60 g in the case of single channel recording and up to 500 g in that of multichannel recording. The radio receiving device consists of an antenna, a receiver with automatic frequency and volume control, a selective-amplifier unit for multichannel recording, and an oscillograph. The system operates in a range of 40 mc. Descriptions are given of the use of single channel systems in recording breathing, pulse rate, movement of the extremities, body temperature, heart tones, the bioelectric potentials of the brain, and the oxygen saturation of the blood. The multichannel apparatus is capable of recording up to six of these functions simultaneously. A.W.

N64-21553 Illinois U., Urbana

CARDIOVASCULAR EFFECTS OF REFEEDING STRESS FOLLOWING SATURATION. XII. CONTINUATION OF LONG-TERM STARVATION AND REFEEDING EPISODES, FINAL EPISODES AND POST MORTEM RESULTS

G. S. Smith, B. Connor Johson, and R. L. Huston Fort Wainwright, Alaska, Arctic Aeromed. Lab., Oct. 1963 17 p refs

(Contract AF 41(657)-359)

(TM-62-6; AD-434116)

The responses of young adult swine to a long-term episode of starvation and refeeding are discussed. The animals received an initial feeding of glucose plus thiamine and then were given a diet high in glucose content, with or without supplemental thiamine. Observations were then made of the blood pressures, heart and respiratory rates, and electrocardiograms of the animals when subjected to starvation and refeeding for even longer periods of time than previously. The same observations of the animals were made during a prolonged period of weight maintenance, after repeated episodes of starvation and refeeding. The entire project sought to determine which, if any, are the principal factors in the diet that may induce and/or aggravate cardiovascular stress during refeeding after starvation. A.W.

N64-21554 Northwestern Technological Inst., Evanston, Ill.

COMBUSTION OF HUMAN WASTE AND PRODUCT RECOVERY

J. E. Quon, W. O. Pipes, and J. A. Logan Fort Wainwright, Alaska, Arctic Aeromedical Lab., Oct. 1963 10 p

(Contract AF 41(657)-383)

(TN-62-16; AD-434115)

Study of the kinetics of combustion of volatilized wastes was continued. A new method of CO_2 analysis was tried. The new method employs the chemical reaction: $Ba(OH)_2 + CO_2 = Ba\,CO_3 + H_2O$. The amount of $Ba(OH)_2$ which reacts with CO_2 is determined by back filtration with oxalic acid, using phenolphthalein as the indicator. Additional information on the relationship between residual weight and oxygen supply, and between residual carbon and oxygen supply, was obtained with the volatilization chamber operated at 200° C. The differences in solubility of the residue after ignition in a muffle furnace and in the volatilization chamber were investigated. A series of experiments to determine the growth characteristics of *Chlorella* on the residue was undertaken. In particular, the

ratio of the concentration of urea to residue at which some nutrient in the ash became limiting was determined.
P.V.E.

N64-21591 Brookhaven National Lab., Upton, N.Y.
THE BIOLOGY OF AGING Brookhaven Lecture Series No. 34
Howard J. Curtis 18 Mar. 1964 18 p refs
(Sponsored by AEC)
(BNL-854(T-340))

Ionizing radiation accelerates the aging process and has been used as a tool to study the biological mechanisms of aging. Aging is a slow deterioration with time that manifests itself by an increased susceptibility of the organism to all kinds of disease. Of the many theories of aging, the wear and tear theory and the somatic mutation theory seemed most promising. A series of experiments has shown that stress per se is not a factor in aging. A method has been developed for measuring somatic mutations in mice, and it was shown that in all cases tested so far there is a quantitative correlation between aging and the development of somatic mutations. The simple somatic mutation theory of aging must be modified to account for the long delay between the production of a mutation and its effect on shortening life expectancy. This modified theory correlates many phenomena known to be associated with aging. Author

N64-21595 School of Aerospace Medicine, Brooks AFB, Tex.
MICROBIOLOGIC STUDIES OF THE TWO-MAN SPACE CABIN SIMULATOR: INTERCHANGE OF ORAL AND INTESTINAL BACTERIA
James E. Moyer and Y. Z. Lewis Mar. 1964 14 p refs
(SAM-TDR-64-3; AD-439097)

Studies were initiated to gain an understanding of the degree of microbic interchange to be expected between individuals under conditions of close occupancy, as would occur during space travel. Experiments were performed on subjects confined within the 2-man space cabin simulator. Results from 11 experiments, lasting from 14 to 30 days, are presented. Oral and intestinal surveys were conducted on each individual prior to, during, and following confinement. "Marker" organisms, initially harbored by only one of the individuals, were used to establish evidence of microbic interchange. Implications of these findings, as related to future space flights, are discussed. Author

N64-21597 Minnesota U., Minneapolis
THORACIC CAGE IMPEDANCE MEASUREMENTS: IMPEDANCE PLETHYSMOGRAPHIC DETERMINATION OF CARDIAC OUTPUT (A COMPARATIVE STUDY)
Edwin Kinnen, William Kubicek, and R. Patterson Brooks AFB, Tex., School of Aerospace Med. Mar. 1964 12 p refs
(Contract AF 41(657)-403)
(SAM-TDR-64-15; AD-439088)

Two band electrodes of tinned copper braid shielding 1-cm wide were placed around the neck and thorax 2 cm below the xiphisternal joint and connected to an electrical bridge circuit excited at 100 kc. The recorded change of impedance over a cardiac cycle was related proportionally to a nominal ventricular stroke volume by the ratio of thorax volume to the average measured impedance. A value of cardiac output, determined from the product of this ventricular stroke volume and the pulse rate, was determined for various subject body types and used to compute the cardiac index and cardiac output per unit body mass. The data were representative of the data reported in the literature. The correlation of cardiac output values, determined from the impedance product, with oxygen consumption rates was found to be 0.962. Author

N64-21642 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ABSORBED DOSES OF COSMIC RADIATION RECEIVED BY A. G. NIKOLAYEV AND P. R. POPOVICH DURING THEIR TWIN ORBITAL FLIGHT
I. B. Keirim-Markus, N. A. Sergeyeva, and L. N. Uspenskiy *In its* Cosmic Res. 29 Oct. 1963 p 321–325 refs (See N64-21626 15-01)

An account is given of the results of the measurements of cosmic radiation tissue doses during the twin flight, which were carried out by personal dosimeters placed in the flying suits of the cosmonauts. The average tissue dose rate was 16 mrad/day and was appreciably greater than during the flight of G. S. Titov, whereas the bremsstrahlung-dose rate was less. An estimate of the upper limit of the neutron flux in the cabin of the space vehicle is given. Author

N64-21643 Air Force Systems Command, Wright-Patter- AFB, Ohio Foreign Technology Div.
EFFECT OF THE SPACE FLIGHT CONDITIONS IN VOSTOK-3 ON SEEDS OF HIGHER PLANTS
L. K. Gordon, N. L. Delone, V. V. Antipov, and V. G. Vysotskiy *In its* Cosmic Res. 29 Oct. 1963 p 326–331 refs (See N64-21626 15-01)

Evidence is cited that shows that the conditions of space flight affect the viability of certain higher plants, causing stimulation or inhibition of germination. Beans and pine demonstrated a tendency toward an increase in the number of chromosomal rearrangements. Author

N64-21644 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A FURTHER STUDY OF THE EFFECT OF SPACE FLIGHT CONDITIONS ON THE CHROMOSOMES OF THE PRIMARY ROOTLETS OF GERMS IN PEA AND WHEAT SEEDS
V. V. Khvostova, S. A. Gostimskiy, V. S. Mozhayeva, and L. V. Nevzgodina *In its* Cosmic Res. 29 Oct. 1963 p 332–341 refs (See N64-21626 15-01)

The effect of space-flight conditions on the chromosomes of peas and wheat, the seeds of which were on the Vostok-3 and Vostok-4, was studied. Also studied was the effect of vibrations and high-energy protons in order to reveal what factors act during a space flight. Under space-flight conditions a small but statistically significant increase in the percent of chromosomal rearrangements is observed in the rootlet cells of the germs of air-dried wheat and pea seeds. The increase in the percent of rearrangements does not depend on the flight duration. Author

N64-21645 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A CASE OF ACUTE RADIATION SICKNESS IN MAN
O. G. Alekseyeva, A. F. Bibikova, N. A. Vyalove, A. Ye. Ivanov, N. A. Krayevskiy et al 1 Oct. 1963 167 p refs Transl. into ENGLISH of the book "Sluchay Ostroy Lucnevoy Bolezni u Cheloveka" Moscow, Gos. Iz. Med. Lit., 1962 p 1–150
(FTD-TT-63-558/1+2; AD-422964)

Described is an extremely severe case of acute radiation sickness, having a lethal outcome, that was observed and studied in great detail. The following data are presented on the history of the disease: (1) clinical data; (2) clinical course of the disease; (3) hematological changes; (4) changes in biochemical indices; (5) state of natural immunity and autoflora; (6) pathologoanatomical data; (7) autopsy data; (8) microscopic investigation; and (9) a discussion of the pathologoanatomical data. N.E.A.

N64-21662 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ABOUT AMABIOSIS IN THOUSAND YEAR OLD PERMAFROST

A. Ye. Kriss and N. A. Grave 31 Jan. 1964 9 p refs Transl. into ENGLISH from Mikrobiologiya (Moscow), v. 13, No. 5, 1944 p 251–255

(FTD-TT-63-926/1+2; AD-433189)

Microbiological investigations were conducted to determine the presence of a bacterial population in the monolith of mineral ice, i. e., to explain the possibility of revivifying microorganisms. Results indicate the absence, in the monolith of mineral ice, of microorganisms capable of reviving vital activity after tens of thousands of years of remaining in the frozen state. The microflora, observed in the outer parts of the ice, were apparently brought in at the time of transportation or during the taking of the monolith. I.v.L.

N64-21673 Martin Co., Denver, Colo.

TOXICANT ENTRAINMENT TEST—CLOTHING OUTFIT, ROCKET FUEL HANDLERS A/P 22P-1

R. G. Hanson Jan. 1964 12 p

(Contract AF 04(647)-576)

(AD-431540)

The objective of this test was to determine the danger to personnel wearing torn protective clothing while subjected to vaporous propellants. Only NO_2—N_2O_4 vapors were used in the test that was conducted in a test chamber 8 × 8 × 8 ft. The reading of the two ASI sensors was taken at time 0. Under normal operation the suit is pressurized to 0.5 in. of water pressure from the (environmental control units) airflow in conjunction with the suit pressure relief valves. When the suit is torn, it deflates and the airflow escapes through the hole. The test shows that NO_2-N_2O_4 will enter the suit at such a high rate that the wearer must remove it immediately. The closer a tear occurs to the recirculation inlet of the ECU, the faster the concentration builds up in the helmet. A.W.

N64-21680 California U., Berkeley Electronics Research Lab.

BIOLOGICAL USES OF NONIONIZING RADIATION Annual Scientific Report, 1 Sep. 1962–31 Aug. 1963

C. Susskind and P. O. Vogelhut 31 Oct. 1963 30 p refs

(Contract Nonr-222(92))

(Rept.-63-27; AD-433659)

Hall effect in water and ice, protonic semiconductors, and electromagnetic effects on the nervous system are discussed. Both theoretical and experimental investigations were undertaken. Hall-effect measurements by the Faraday-rotation method proved to be unsatisfactory, but measurements by other methods are being pursued. Study of protonic semiconductor led to the development of a rectifying diode junction with interesting properties. The method of accurate and rapid dielectric-constant measurements developed during a previous contract period was applied to measurements of changes in the electrical properties of nerves during transmission of action potentials. Author

N64-21698 Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia)

DETERMINATION OF RUBIDIUM IN AGRICULTURALLY IMPORTANT MATERIALS THROUGH ATOMIC ABSORPTION-FLAME PHOTOMETRY [RUBIDIUMBESTIMMUNG IN AGRIKULTURWICHTIGEN MATERIALEN DURCH ATOMABSORPTIONS-FLAMMEN PHOTOMETRIE]

J. Stupar Jan. 1964 13 p refs In GERMAN Submitted for Publication

(NIJS-R-425)

Flame photometry was employed as an exact and rapid method for the determination of rubidium in plants and soil extracts. The method is practically free of cation disturbances (except in the case of Cs), whereas H_3PO_4, HCl, and $HClO_4$ cause a rather large reduction in absorption. The light emission of the flame, which originates mainly from the potassium-767 mμ line, can be decreased by a lens. Due to the high salt concentration and the presence of H_3PO_4 and H_2SO_4 in the investigated solutions, corresponding standard solutions must be used. Transl. by I.v.L.

N64-21729 Joint Publications Research Service, Washington, D.C.

RESEARCH ON RADIATION SICKNESS AND PROTECTIVE MEASURES

A. M. Stashkov, V. P. Korotkova, Yu. Ya. Saydakovskiy, and A. F. Mosin 28 May 1964 19 p refs Transl. into ENGLISH of 3 articles from Farmakol. i Toksikol. (Moscow), v. 27, no. 1, 1964

(JPRS-24817; OTS-64-31356) OTS: $0.50

The following areas of research are discussed: (1) radioprotective properties of neurotropic pharmacological agents of the antifeine group—comparison of certain characteristics of derivative diamides of imidazoldicarbonic acids during general X-ray irradiation of animals with lethal doses; (2) the effect of aminasine, promedol, and dimedrol on the duration of barbamyl-induced sleep in healthy animals and under conditions of experimentally-produced radiation sickness; and (3) radioprotective properties of izotiuronic derivatives of pyridoxine. P.V.E.

N64-21733 Brookhaven National Lab., Upton, N.Y.

TRACE METALS: ESSENTIAL OR DETRIMENTAL TO LIFE

George C. Cotzias 10 Apr. 1964 20 p refs *Its* Lecture Series No. 26

(Sponsored by AEC)

(BNL-828-(T-323)) OTS: $0.50

The effects of excess trace elements in the human body show marked similarities to spontaneous extrapyramidal diseases such as Wilson's Disease and Parkinsonism. The mechanisms by which derangement of homeostasis can occur can be explained by the simple mechanisms in manganese poisoning or by the complex mechanism in Wilson's Disease, where normal dietary copper is concentrated within the body leading to copper poisoning. Experiments are described in which radioactive manganese is used to determine the behavior of trace elements in plasma. Experiments of drug action and trace elements led to a theory attributing the pharmacological effects of the drug to free-radical formation. Free-radical reactions with melanin have been studied, and since the loss of melanin from the substantis nigra of the brain in Parkinsonism cases has been established, further study of melanocytes and trace elements is suggested. D.S.G.

N64-21783 Joint Publications Research Service, Washington, D.C.

METHODS OF SIMULTANEOUS STUDY OF THE BLINKING CONDITIONED REFLEXES AND THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM IN A HUMAN

F. M. Lebedev and M. G. Kheyfets 5 Jun. 1964 8 p refs Transl. into ENGLISH from Zh. Vyssh. Nervn. Deyat. (Moscow), v. XIV, no. 2, Apr. 1964 p 346–368

(JPRS-24967; OTS-64-31425) OTS: $0.50

A method for synchronously studying the state of the central nervous system and the human blood-circulation system

under clinical conditions is presented. A setup for simultaneous study of the eyelid conditional reflexes and the functional state of the human cardiovascular system was developed; the arrangement of the setup is described. A demonstrated combination of cardiocurves and sphygmographic curves enabled the determination of the frequency and rhythm of heart contractions, the duration of electrical and mechanical systoles, the duration of various phases of the systole of the left ventricle, the diffusion rate of the pulse wave through the vessels of varying caliber, as well as an evaluation of pulse volume. N.E.A.

N64-21803 Minnesota U., Minneapolis
THORACIC CAGE IMPEDANCE MEASUREMENTS. TISSUE RESISTIVITY IN VIVO AND TRANSTHORACIC IMPEDANCE AT 100 kc
Edwin Kinnen, William Kubicek, P. Hill, and G. Turton Brooks AFB, Tex., School of Aerospace Med., Mar. 1964 18 p refs
(Contract AF 41(657)-403)
(SAM-TDR-64-5; AD-439353)

Average volume resistivities for thoracic tissues at an exciting frequency of 100 kc are required for studies of the current flux paths in transthoracic impedance plethysmography. By using a uniquely designed probe and anesthetized dogs, an average tissue resistivity was found for skeletal muscle to be approximately 400 ohm cm; heart muscle, 450 ohm cm; lung tissue, 1,200 to 1,500 ohm cm; kidney and liver, 600 ohm cm; fat, 1,000 to 2,000 ohm cm; and for whole canine blood, 150 ohm cm at a hematocrit of 45. With the exception of whole blood, all values varied significantly between dogs and between individual readings. The values for lung and liver tissues and for fat were noted to have particularly large variations between readings and between animals. Canine skeletal muscle tissue had a linear electrical resistivity characteristic for excitation current densities up to 80 ma./cm^2. Representative normal, human skin on the biceps was shown to contribute approximately $4.5 \times 10^{-3} \times \epsilon^{150^\circ}$ mhos/cm^2 of electrode surface area in series with the transthoracic impedance, with possible modifications required for electrode geometry and electrode paste. Author

N64-21816 Stanford U., Calif. School of Medicine
EFFECT OF CHRONIC HYPOXIA UPON THE CIRCULATION Annual Progress Report, Mar. 1, 1963–Feb. 29, 1964
Herbert N. Hultgren 10 Mar. 1964 7 p refs
(Contract DA-49-193-MD-2274)
(AD-433546)

Reported are two cases of high-altitude pulmonary edema. An analysis of treatment methods of the disease revealed that 100% oxygen by face mask is preferable. Control studies at sea level are being performed on normal subjects to compare with similar studies on high-altitude-acclimatized natives. The circulatory effect of severe hypoxia and of exercise during hypoxia is being studied. Post mortem perfusion studies of the coronary vascular bed in dogs from sea level and high altitude have been compared. The results indicate that the flow capacity of the coronary vascular bed at high altitude is no larger than at sea level and that, presumably, adaptation to high altitude does not involve an increase in the flow capacity of the coronary bed. N.E.A.

N64-21826 Joint Publications Research Service, Washington, D.C.
SYNCHRONIZATION OF MOTOR UNITS AND RELATED MODEL REPRESENTATIONS
I. M. Gel'fand, V. S. Gurfinkel', Ya. M. Kots, M. L. Tsetlin, and M. L. Shik 14 May 1964 29 p refs Transl. into ENGLISH from Biofizika (Moscow), v. 8, no. 4, 1963 p 475–486
(JPRS-24606; OTS-64-31260) OTS: $0.75

An investigation was conducted in order to explain the operating condition of muscles at work when assigned a task to maintain a definite position. An attempt was made to explain the results by establishing certain model representations. The experimental part of the work consisted of recording the activity of individual motor units, both in healthy persons as well as in those affected with Parkinsonism. The experiments show that in a normal person, motor units work asynchronously as though they were almost completely independent. A detailed analysis of this finding is included. R.T.K.

N64-21837 Tennessee Valley Authority, Oak Ridge
RADIOLOGICAL HEALTH MANUAL FOR THE EXPERIMENTAL GAS-COOLED REACTOR. RADIATION PROTECTION STANDARDS AND REGULATIONS
O. M. Derryberry and W. R. Cooper 26 Mar. 1964 155 p
(Contracts TV-21280A; AT(40-1)-2742)
(EGCR-4) OTS: $2.75

The following are discussed: (1) administration—Experimental Gas-Cooled Reactor radiological health policy, indoctrination and training in radiological protection, and plant safeguards review; (2) radiation protection guides—radiation and contamination standards; (3) radiation and contamination control; (4) radioactive source and waste management; (5) medical services; (6) emergencies and unusual incidents; (7) definitions, symbols, abbreviations, units, and equivalents; (8) Experimental Gas-Cooled Reactor radiation detection instruments; (9) zoned areas for radiation hazard and exposure control; (10) shipments of spent fuel, irradiated specimens, and source and special nuclear materials to off-area locations; and (11) use of respiratory protective equipment. R.T.K.

N64-21844 General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
BIBLIOGRAPHY ON COMPRESSED AIR SYSTEMS-SAFETY CONSIDERATIONS (SELECTED REFERENCES)
Helyn Walton, comp. Oct. 1963 14 p refs
(KAPL-M-TL-1)

N64-21850 Joint Publications Research Service, Washington, D.C.
VESTNIK AKADEMII MEDITSINSKIKH NAUK SSSR (HERALD OF THE ACADEMY OF MEDICAL SCIENCES USSR), Vol. XVIII, No. 12, 1963
29 Apr. 1964 136 p refs Transl. into ENGLISH of p 3–97
(JPRS-24398; OTS-64-31179) OTS: $2.75

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2. SOME PRACTICAL ACHIEVEMENTS OF MEDICAL GENETICS V. P. Efroimson p 17–30 refs
3. ABERRANT KARYOTYPES IN THE TISSUE CELLS OF AN ABORTED FETUS Yu. L. Menitskiy p 31–35 refs
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5. THE SIGNIFICANCE OF HEREDITY AND ENVIRONMENT IN THE DEVELOPMENT OF ESSENTIAL HYPERTENSION AND DISORDERS OF LIPID METABOLISM I. A. Ryvkin and L. N. Ignatova p 41–47 refs

6. GENETIC RECOMBINATIONS IN BACTERIA A. P. Pekhov p 48–61 refs

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8. CHANGE IN THE CELLULAR GENETIC STRUCTURES UNDER THE INFLUENCE OF 5-BROMOURACIL A. G. Skavronskaya p 74–87 refs

9. LYTIC REACTIONS OF PHAGE INFECTION V. A. Zuyev p 88–102 refs

10. SOME PROBLEMS OF THE REGULATION OF ACTIVITY AND SYNTHESIS OF ENZYMES AND BACTERIA V. N. Gershanovich p 103–115 refs

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13. SYSTEMATIC INDEX OF ARTICLES PUBLISHED IN THE J. VESTN. AKAD. MED. NAUK SSSR IN 1963 p 125–132

N64-21851 Joint Publications Research Service, Washington, D.C.

VESTNIK OF USSR ACADEMY OF MEDICAL SCIENCES, NO. 1, 1964

18 May 1964 141 p refs Transl. into ENGLISH of Vestnik Akad. Med. Nauk. SSR (Moscow), v. 19, no. 1, 1964 p 3–96 (JPRS-24638; OTS-64-31277) OTS: $2.75

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5. TOWARD A DEFINITION OF THE CONCEPT "LIFE" V. M. Zhdanov p 35–44

6. THE PROBLEM OF REGRESSION IN BIOLOGY V. V. Kupriyanov p 45–60 refs

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9. COLICINE PRODUCTION AS A GENERAL BIOLOGICAL PROBLEM V. D. Timakov et al p 83–99 refs

10. THE RELATIONSHIP OF THE MUTAGENIC EFFECT OF 2-CHLOROALKYLAMINES AND THE STRUCTURE OF THEIR FUNCTIONAL GROUPS AND RADICALS S. I. Alikhanyan and M. G. Oganesya p 100–118

11. ALL-UNION CONFERENCE OF GERONTOLOGISTS P. D. Marchuk p 119–125

12. JOINT SEVENTH SCIENTIFIC SESSION OF THE INSTITUTE OF POLIOMYELITIS AND VIRUS ENCEPHALITIDES OF THE ACADEMY OF MEDICAL SCIENCES USSR Ye. N. Levkovich p 126–137

N64-21866 Joint Publications Research Service, Washington, D.C.

SPACE BIOLOGY AND MEDICINE

V. I. Yazdovskiy 4 Jun. 1964 51 p Transl. into ENGLISH from the Monograph "Biologiya i Kosmos (Problemy Kosmicheskoy Biologii i Meditsiny)" Moscow, Znaniye Publishing House, ser. VIII, no. 1–2, 1964 p 36–79 (JPRS-24943; OTS-64-31414) OTS: $1.25

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1. FIRST EXPERIMENTS p 2–12 (See N64-21867 15-16)

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4. AFTER A LONG DISTANCE—A LONG DISTANCE p 42–49 (See N64-21870 15-29)

N64-21867 Joint Publications Research Service, Washington, D.C.

FIRST EXPERIMENTS

V. I. Yazdovskiy *In its* Space Biol. and Medicine 1964 p 2–12 (See N64-21866 15-16) OTS: $1.25

Original experiments in the medical–biological problems of space exploration are discussed. Space-capsule simulation, extreme gravity tests, development of space suits, and recovery from high-altitude rocket flights are included in the discussion. P.V.E.

N64-21868 Joint Publications Research Service, Washington, D.C.

NEW HEIGHTS — NEW CONQUESTS

V. I. Yazdovskiy *In its* Space Biol. and Medicine 1964 p 13–22 (See N64-21866 15–16) OTS: $1.25

A brief discussion is presented of the initial experiments carried out during the launching and orbiting of the first satellites to carry living organisms (dogs, mice, flowers, seeds, fungi, etc.). P.V.E.

N64-21869 Joint Publications Research Service, Washington, D.C.

TOWARD A DREAM

V. I. Yazdovskiy *In its* Space Biol. and Medicine 1964 p 23–41 (See N64-21866 15–16) OTS: $1.25

The choosing and training of astronauts for the first space flight are discussed. Also included is a brief narrative of the highlights of the first space flight, along with a discussion of some of the astronauts' reactions both during and after the flight. P.V.E.

N64-21928 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BIOLOGICAL RADIO COMMUNICATION

B. Kazhinskiy 1 Mar. 1963 14 p Transl. into ENGLISH from Rabochaya Gazeta (USSR), 13, 15, & 16 May 1962 p 4 (FTD-TT-62-1876/1; AD-400553)

This article briefly reviews evidence of extrasensory perception, including human communication with animals. The current Russian interest in psychic phenomena is reflected. Most of the cases cited took place in the Soviet Union, although a current American experiment was mentioned. G.D.B.

N64-21941 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PHYSIOLOGICAL REACTIONS OF THE HUMAN ORGANISM DURING THE ACTION OF ACCELERATIONS, MAXIMUM IN TIME AND INTENSITY, DIRECTED ALONG THE SPINE-BREAST AXIS
A. A. Barer, G. A. Golov et al 10 Dec. 1963 12 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), no. 7, 1963 p 24–29
(FTD-TT-63-1095/1+2; AD-426900)

Physiological reactions of the circulatory system, respiratory system, coordinations of movements, bioelectrical activity of the brain, and bioelectrical activity of different groups of skeletal muscles are discussed. Experiments were conducted using a large radius centrifuge. The first acceleration was 4 g. The average limit of endurance for 6 g was 653 seconds; for 8 g, 186 seconds; for 10 g, 58 seconds; for 12 g, 28 seconds; for 14 g, 18 seconds; and for 15 g, 10 seconds. I.v.L.

N64-21973 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SPACESUITS
Yu. Savitskiy 26 Mar. 1964 13 p refs Transl. into ENGLISH from Nauka i Zhisn' (Moscow), no. 12, 1963 p 40–44
(FTD-TT-64-134/1+2+4; AD-435997)

The present and the future functions of spacesuits and the future changes in spacesuits are discussed. Specifically considered are breathing and ventilation in spacesuits and problems of pressure and decompression on the spacesuits. Discussed also is the design of a "spacesuit-house." N.E.A.

N64-22042 Flight Safety Foundation, Inc., New York, N.Y.
AIR SAFETY: A STUDY OF ETHICS, ECONOMICS AND ATTITUDES
Jerome Lederer, Robert N. Buck, Najeeb E. Halaby (FAA), Robert T. Murphy (CAB), Maynard L. Pennell (Boeing Co.) et al 1964 40 p refs *In* Connecticut General Flight Forum, Winter–Spring 1964

Background necessary for an understanding of air safety problems is presented; important questions of policy, especially those deriving from manmade problems, are also discussed. Explored are the difficulty of measuring air safety, the current levels of safety, the inadequacy of statistics as a means of convincing the public that air transportation is within normal living risk range, and many other problems created by a fact peculiar to air transportation—the catastrophic nature of its accidents. Emphasis is placed on problems created by the social, political, and economic climate in which aviation is required to operate. P.V.E.

N64-22049 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE RADIOACTIVE CONTAMINATION OF THE BIOSPHERE AND MEASURES OF COMBATTING THESE CONTAMINATIONS
N. V. Timofeyev-Resovskiy 13 Aug. 1963 17 p refs Transl. into ENGLISH from Tr. Inst. Biol. (Sverdlovsk), no. 22, 1962 p 7–16
(FTD-TT-63-664/1; AD-416753)

All of the numerous possibilities of radioactive contamination of the biosphere can be divided into two basic groups: (1) local contamination; and (2) broad contamination. The first group includes those cases in which radioactive dust particles and radioactive contaminated waters cause local contamination of specific territories and water reservoirs. The second group includes radioactive contamination due to the testing of atomic and thermonuclear weapons. In this case, maximum concentration is in the biomass and surface layer of the soil. Suggested methods for combating these contaminations include these measures: (1) to reduce to a maximum the possibility of the formation of radioactive dust in the center of contamination (e.g., thorough plowing and full turnover of the plowed ground); (2) to prevent the escape of radioisotopes from concentration centers by runoff water (e.g., by building settling brooks for contaminations flowing through brooks and small rivers); (3) to reduce to a minimum the paths of the biological migration of radioisotopes from contaminated centers (e.g., by creating narrow desert areas, several meters wide around points of maximum concentration and by preventing the migration of animals); and (4) to discontinue the use, especially of food and feed, of the entire bioproduction from contaminated areas and water reservoirs. I.v.L.

N64-22071* National Aeronautics and Space Administration, Ames Research Center, Moffet Field, Calif.
LIMITATIONS IN THE USE OF CARBON-LABELED AND TRITIUM-LABELED THYMIDINE IN CELL CULTURE STUDIES
Robert B. Painter, Ruth M. Drew (Brookhaven Natl. Lab.), and Ronald E. Rasmussen Repr. from Radiation Research, v. 21, no. 3, Mar. 1964 p 355–366 refs Work Performed in Cooperation with Brookhaven Natl. Lab.
(Supported by AEC)
(NASA-RP-196)

Experiments have been performed with C^{14}-thymidine or labeled thymidine added to HeLaS3 cell cultures growing in Eagle's medium. The results are as follows: (1) Thymidine in the culture causes a concentration-dependent inhibition of growth, with effects being significant at levels as low as 10μg/ml. (2) Thymidine in the medium reduces the incorporation of H^3-uridine into both DNA and RNA; the effect on incorporation into RNA is unexpectedly large. (3) Other nucleosides, added singly or together to the medium, cause effects similar to those induced by thymidine. Thirty-minute incubations with tritiated thymidine, at concentrations from 0.02μg/ml to 2.5μg/ml, and at two specific activities, did not affect the production of colonies of the HeLaS3 cultures. N.E.A.

N64-22073 National Academy of Sciences—National Research Council, Washington, D.C. Space Science Board
WORKING GROUP ON GASEOUS ENVIRONMENT FOR MANNED SPACECRAFT Summary Report, Oct. 1963
Jan. 1964 62 p refs

This report describes the results of discussions of the physiological criteria that are important in the selection of the cabin atmosphere in manned spacecraft and discussions, experimental procedures, and investigations that should both precede and accompany preparations for the further development of manned space flight. Author

N64-22075
PASSENGER TOLERANCE TO TRANSVERSE ACCELERATION AND DECELERATION FORCES (EYE-BALLS IN; EYE-BALLS OUT)
R. J. Del Vecchio 21 Feb. 1963 4 p

An investigation of the tolerance of a passenger to acceleration or deacceleration (using a lap belt and shoulder harness for restraint) is discussed. The investigation used as subjects young flying personnel. Conclusions are as follows: (1) Lap belts and shoulder harnesses are absolutely necessary for body restraint and tolerance to gravity forces. (2) Restraint-system tension depends upon the physical stature and conditioning of the passenger. (3) Young, healthy men and women can tolerate up to 5.5 g for a time duration of 4 minutes. (4) It is practically

impossible to state a universal g tolerance for all types of passengers under all statures and physical conditions. P.V.E.

N64-22077 St. Louis U., Mo.
RENEWAL OF INTESTINAL EPITHELIUM IN THE FRESHWATER TURTLE, *CHRYSEMYS PICTA*
Mary Alan Wurth and X. J. Musacchia Repr. from Anat. Record, v. 148, no. 3, Mar. 1964 p 427–439 refs
(Grant NSG-271-62)

In the intestinal epithelium of *Chrysemys picta*, cellular proliferation was observed to occur in the layer of cells adjacent to the basement membrane. Mitosis occurred throughout the epithelium at a fairly low rate (mitotic index 0.0016). In the upper intestine fewer labeled cells were found in the apical one-third of a villusfold than in either the mid or the basal one-third. The time required to renew the intestinal epithelium was estimated to be about 8 weeks in winter turtles maintained at 20° to 24° C. Cell loss from the system appeared to be due to a randomly located movement of cells lumenward from the basement membrane. Mitotic activity in cold torpid turtles (11° C ambient temperature) appeared to be completely suppressed, as shown by a lack of incorporation of tritiated thymidine and an absence of mitotic figures in the intestinal epithelium. Author

N64-22133 Aeronautical Research Labs., Melbourne (Australia)
AIRLINE PILOTS' EYE MOVEMENTS DURING TAKEOFF AND LANDING IN VISUAL METEOROLOGICAL CONDITIONS
D. Lennox Aug. 1963 20 p
(ARL/HE-15)

To obtain information on the visual behavior of pilots during takeoff and landing in visual meteorological conditions in daylight, a cine record of pilots' eye movements was made on Electra and Boeing 707 aircraft on normal passenger-carrying flights. Interest was directed initially to the analysis of periods of attention, the in-to-out ratio of attention and the general scanning pattern. The greater amount of attention and the longer glances were directed to the instruments during takeoff, but to external visual cues during landing. Different pilots followed different visual scanning patterns, although individuals tended to conform to the same pattern on different occasions. The scanning patterns of Electra and Boeing pilots were similar, but the Electra patterns showed more variance, probably because the runway performance of the aircraft was less critical. The Boeing data show that scanning patterns were affected when operating into and out of an unfamiliar airfield with inhospitable surrounding terrain; the Electra data showed no differences between three familiar capital city airports with clear aproaches. Author

N64-22141 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW FREELY LIVING NITROGEN FIXING MICROORGANISMS
N. P. L'vov 15 Nov. 1963 23 p refs Transl. into ENGLISH from Izv. Akad. Nauk, SSSR, Ser. Biol. (USSR), no. 2, 1963 p 270–282
(FTD-TT-63-1010/1; AD-425497)

By using the isotopic method in the study of nitrogen fixation, the nitrogen fixing activity of extremely small microorganisms can be detected. The ability to fix molecular atmospheric nitrogen was established and is described for representatives of all photosynthetic-bacteria families, bacteria of the *Pseudomonas* and *Achromobacter* group, mycobacteria, *proactinomycetes* and *actinomycetes*, *Bacillus polymyxa*, *Aerobacter aerogenes*, sulfate reducing bacteria of the *Desulfovibrio* type, methanobacteria, and a series of unidentified bacteria and several types of yeast. All new nitrogen fixing microorganisms are believed to have an adaptive fermentation system for nitrogen fixation. R.T.K.

N64-22142 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATION OF CATECHOLAMINES IN VARIOUS ORGANS OF DOGS UNDER CONDITIONS OF DEEP HYPOTHERMIA
Ye. P. Stepanyan, V. A. Bukharin, and M. A. Chernyavskaya 26 Dec. 1963 11 p refs Transl. into ENGLISH from Bull. Eksperim. Biol. Med. (USSR), no. 9, 1963 p 56–60
(FTD-TT-63-1096/1+2; AD-428724)

An investigation of the catecholamines in various organs of dogs under deep hypothermia showed that the level of catecholamines in the blood sharply diminished at the maximum cooling temperature of the organism, and especially after stopping the circulation for 15 minutes. Followup on the reperfusion of the cooled blood after a 15-minute stoppage revealed a slight increase in the catecholamines in the blood. The subsequent warming up to the normal temperature of the body brought about an increase in the level of catecholamines by 40 percent. Graphs are presented for changes in the content of catecholamines in the suprarenal glands, in heart muscles, and in the brain. N.E.A.

N64-22143 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE MAXIMUM PRINCIPLE IN THE THEORY OF OPTIMAL CONTROL PROCESSES
V. G. Boltyanskiy, R. V. Gamkrelidze et al 18 Mar. 1963 25 p refs Transl. into ENGLISH from the Book "Printsip Marsimuma v Teorii Optimal'nykh Protsessov Upravieniya" Moscow, v. 2, 1961 p 457–470
(FTD-TT-62-1746/1+2+4; AD-299854)

In this report, a statement of the general optimal problem is presented, and the basic results obtained by previous authors are formulated mathematically. N.E.A.

N64-22160 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRONICS AND INDUSTRIAL SAFETY
P. M. Konin, V. A. Franke et al 25 Mar. 1964 13 p Transl. into ENGLISH from Elektron. v Med. (Moscow), Gosenergoizdat, 1960 p 383–392
(FTD-TT-63-1200/1+4; AD-600581)

Discussed is the application of electronics in the field of industrial safety in order to develop devices for eliminating injuries that might occur when operating various machines. The following areas of electronics as applied to industrial safety are discussed: (1) measuring the intensity of electromagnetic fields of low, high, and ultrahigh frequencies; (2) making instruments that will assure safety while operating electrical equipment; (3) measuring static-electricity potential; (4) measuring noise level and analyzing its frequency; (5) measuring illumination; (6) computing the dust content in the air and analyzing dust dispersion; (7) analyzing the content of harmful admixtures in the air, such as vapors and gases; and (8) measuring radioactive intensity and X-radiation. N.E.A.

N64-22168 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PHYSIOLOGICAL JOURNAL OF THE USSR (SELECTED ARTICLES)

14 Feb. 1963 33 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 48, no. 4, 1963 p 436–443, 455–463 (FTD-TT-62-1176/1+2+4; AD-297570)

CONTENTS:

1. PHYSIOLOGICAL MECHANISMS OF CHEMICAL THERMOREGULATIONS K. P. Ivanov p 1–14 refs (See N64-22169 15-16)

2. FUNCTIONAL CHANGES IN AN ORGANISM AS A RESULT OF BREATHING A HIGH OXYGEN–LOW CARBON DIOXIDE GAS MIXTURE FOR MANY HOURS AT REST AND DURING EXERCISE S. A. Brandis and V. N. Pilovitskaya p 15–30 refs (See N64-22170 15-16)

N64-22169 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PHYSIOLOGICAL MECHANISMS OF CHEMICAL THERMOREGULATIONS

K. P. Ivanov *In its* Physiol. J. of the USSR (Selected Articles) 14 Feb. 1963 p 1–14 refs (See N64-22168 15-16)

To investigate increase in the general gas exchange of animals during their cooling, experiments were conducted to determine directly the oxygen requirement of animal muscles in situ at different body temperatures. On cooling, the rabbits with the occurrence of thermoregulation tonus in their skeletal muscles had the oxygen consumption by their muscles increased by as much as 150% or more from the initial level. On deeper cooling and the occurrence of shivering, the oxygen consumption by muscles increased by as much as 200% to 400% or more. After cutting the spinal cord at the thoracic division or the somatic nerves innervating the given muscles, thermoregulation tonus and shivering did not occur when the unanesthetized animals were cooled. The corresponding reactions of gas exchange of the investigated muscles also disappeared. It is concluded that an effective increase in heat production in the skeletal muscles during chemical thermoregulation even with complete apparent rest of the organism and in the absence of shivering can occur only if motor innervation is preserved. P.V.E.

N64-22170 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

FUNCTIONAL CHANGES IN AN ORGANISM AS A RESULT OF BREATHING A HIGH OXYGEN-LOW CARBON DIOXIDE GAS MIXTURE FOR MANY HOURS AT REST AND DURING EXERCISE

S. A. Brandis and V. N. Pilovitskaya *In its* Physiol. J. of the USSR (Selected Articles) 14 Feb. 1963 p 15–30 refs (See N64-22168 15-16)

The following conclusions were reached: (1) On inspiration of 2% concentrations of CO_2, a significant increase (26%) of pulmonary ventilation was observed in the test subjects while at rest. When the subjects exercised, a significant increase of ventilation was noticed at a 1% concentration (8.4%) and at the 2% concentration the increment average was 28.8%. (2) An increase in the oxygen content in the inspired gas mixture produced an increase in the sensitivity of external respiration to the inspired carbon dioxide. (3) Prolonged inspiration of high CO_2 concentration (0.25% to 2%) leads to a noticeable drop of gaseous and tissue exchange, which is more pronounced under conditions of hyperoxia. (4) During many hours breathing in a respirator, particularly while performing physical work, the average CO_2 content in the inspired gas mixture should not exceed 0.25%. The maximal tolerable passage of CO_2 with an oxygen concentration up to 50% in the breathing system of the respirator can be 2%. At high oxygen concentration in the gas mixture in the respirator, the passage of CO_2 should not exceed 1%. P.V.E.

N64-22180 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METHOD OF VENTILATION OF CLOTHING OF CREW MEMBERS OF AIRCRAFT

A. A. Stasyuk, Ya. G. Rubashkin, and Yu. M. Petrov 15 Aug. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 142157, 14 Feb. 1961 p 1–4

(FTD-TT-63-774/1+2; AD-417578)

A method of ventilating the clothing of members of aircraft crews making use of drop in pressure is described. This method is distinguished from previous methods in that the air is drawn through the clothing along air ducts connecting the clothing with the hermetically sealed cabin and air ducts connecting the clothing with the surrounding space outside the aircraft. N.E.A.

N64-22182 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PROBLEMS OF CYBERNETICS IN MEDICINE

A. D. Voskresenskiy and A. I. Prokhorov 17 Dec. 1963 29 p refs Transl. into ENGLISH from Kibernetiku Na Sluzhbu Kommunizmu, Sbornik Statey Gosenergoizdat (Moscow-Leningrad), v. 1, 1961 p 126–140

(FTD-TT-63-521/1+4; AD-430544)

The purpose of the cybernetic approach to the investigation of processes of regulation of vital bodily functions is to explain the structure of the control system, its dynamic characteristics, individual variants of the dynamics of control-system functions, and possible disturbances in the system for the control of functions. The prospects of using electronic computers for processing diagnostic information, and automatic control of physiological systems are also discussed. P.V.E.

N64-22203 Israel Society for Scientific Translations, Ltd., Jerusalem

EXCITATORY AND INHIBITORY STATES OF THE BRAIN

B. N. Klosovskii and E. N. Kosmarskaya 1963 465 p refs Tranl. into ENGLISH of "Deyatel'noe i Tormoznoe Sostoyanie Mozga" Moscow, Medgiz, 1961

(Sponsored by NSF)

(IPST-990; OTS-63-11176) OTS: $4.50

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14. STRUCTURE OF NERVE CELLS IN THE BRAIN OF NORMAL ANIMALS p 250–256

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19. ANATOMIC-PHYSIOLOGICAL CONCEPTS OF THE NERVE CELL p 380–396

20. THE PROBLEM OF STRUCTURE OF THE BRAIN p 397–414

21. CONCLUSIONS p 415–419

N64-22218 Flying Personnel Research Committee (Gt. Brit.)

PULMONARY GAS EXCHANGE DURING POSITIVE ACCELERATION

D. H. Glaister (RAF Inst. of Aviation Med.) London, Air Min., Apr. 1963 17 p refs

(FPRC-1212)

Pulmonary gas exchange and lung function were studied in man subjected to positive (tailward, $+G_z$) acceleration in the sitting position. During runs at 2 to 3g lasting 1/2 to 5 minutes, the oxygen uptake fails to rise, or may even fall, despite the fact that an oxygen debt is being built up, which is only repaid on return to 1g. The oxygen debt is increased by increasing either the duration or the severity of acceleration, and is slightly decreased when an anti-g suit is worn. Breathing 100% oxygen has no effect on the development of the debt, which may reach 500 to 600 ml without an increase in oxygen uptake during the period of acceleration. Moderately severe exercise must be performed during acceleration before the oxygen uptake is raised at 2 to 3g, and following such a run the oxygen debt may reach 740 ml. Marked inequalities in ventilation and perfusion are inferred from the pattern of carbon dioxide excretion during tidal and prolonged expirations at 3g, and the effect of these on the reserves of oxygen and carbon dioxide in blood and tissues is discussed. Author

N64-22232 Israel Program for Scientific Translations, Ltd., Jerusalem

THE MOTOR ANALYSOR, EXPERIMENTAL STUDIES

L. S. Gambaryan 1963 174 p refs Transl. into ENGLISH of "Voprosy Fiziologii Dvigatel'nogo Analizatora. Eksperimental'noe Issledovanie" Moscow, Medgiz, 1962

(Sponsored by NSF)

(IPST-1014; OTS-63-11174) OTS: $1.75

A study of the physiological basis of acquired motor acts is discussed. The investigations were accomplished through the method of conditioned reflexes combined with morphological and electrophysiological analysis. The study was concerned with explaining and/or investigating the following: (1) conditioned motor reflexes; (2) conditioned reflexes in dogs with damaged posterior spinal-cord columns; (3) additional pathways of proprioceptive signaling; (4) functional significance of additional pathways of proprioceptive signaling; (5) motor reactions after the destruction of cortical and spinal parts of the motor analyzer; and (6) acquired motor reactions after damage to the cerebellum and posterior spinal-cord columns. P.V.E.

N64-22240 Atlantic Research Corp., Alexandria, Va.

THE EVALUATION AND CONTROL OF TOXICITY HAZARDS IN SOLID PROPELLANT OPERATIONS

Kenneth D. Johnson Jan. 1963 27 p Presented at the Solid Propellant Rocket Conf., ARS, Philadelphia, 20 Jan.—1 Feb. 1963

(ARS Paper-2766-63)

The risks of injury by toxic releases to the atmosphere from propellant operations depend upon physiological, physicochemical, and meteorological factors, as well as the composition of the propellant. The estimation of these statistical risks from an evaluation of these factors is discussed. Minimization of the risks through containment of toxic exhaust products, scheduling of operations during periods of meteorology favorable for rapid atmospheric dilution of toxic emissions, and by operation at highly isolated sites is discussed in principle and illustrated by example. Author

N64-22280 Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.

A METHOD FOR MAINTAINING CHIMPANZEE MEDICAL RECORDS

Richard J. Brown Apr. 1964 17 p

(ARL-TDR-64-5; AD-436729)

The methods described in this report are the results of nearly 10 years of colony operation. During this period many changes were made to tailor the health record to better fit the biomedical research program using chimpanzees. The majority of the chimpanzees were imported from the west coast of Africa. Importation of animals from other parts of the world might well necessitate research colony health record modifications. Greatly altered use of chimpanzees and nonhuman primate colony location in areas climatically diverse from the desert southwest would surely cause other changes to be made in the health records described in this report. Author

N64-22290 Armed Forces Inst., of Pathology, Washington, D.C.

DETERMINATION OF CARBOXYHEMOGLOBIN IN DECOMPOSED BODIES Final Report, Mar. 1962–Mar. 1963

Abel M. Dominguez, James R. Halstead, and Thaddeus J. Domanski Wright-Patterson AFB, Ohio, AMRL, Jul. 1963 19 p refs

(Contract MIPR (33-657)-2-RD-175)

(AMRL-TDR-63-69; AD-420631)

This study is concerned with the interpretation and the significance of carbon monoxide findings in cases associated with

decomposition. The evidence presented indicates that the percentage of carboxyhemoglobin saturation value is not markedly altered during postmortem decomposition when the specimens are properly preserved and when the blood extracted from tissue is examined as soon as possible for the presence of carbon monoxide. Under the conditions studied, it appears possible to obtain carbon monoxide values, using blood extracted from tissue, in the presence of postmortem decomposition that are similar to the antemortem levels. For example, within the 4% to 12% carboxyhemoglobin-saturation range covered in this study, there was no marked increase or decrease in final percentage of carboxyhemoglobin following decomposition. Nevertheless, unreliable carboxyhemoglobin saturation values may occur, and the possible contributory factors responsible for a spurious increase in carboxyhemoglobin values are discussed along with corrective measures. A gas–solid chromatographic procedure using blood or tissue for determining carbon monoxide is presented. This procedure employs a Van Slyke apparatus for liberating gases from biological specimens, modified for introducing released gas into the gas chromatograph.

Author

N64-22317 Chicago Medical School, Ill.

YOUNG'S MODULUS AND BREAKING STRENGTH OF BODY TISSUES Technical Documentary Report, Mar. 1960–31 Dec. 1962

John L. Nickerson and M. Drazic Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs., Mar. 1964 15 p refs

(Contract AF 33(616)-7053)

(AMRL-TDR-64-23; AD-601181)

The measurement of Young's modulus, the breaking strength, and the breaking index in the stretching of tissues of the dog and of humans is reported. The breaking index is defined as the ratio of breaking strength to Young's modulus. These measurements were made by static determinations of the stress–strain relationship. Some twenty-three different tissues or segments of tissue were used in these tests. The results reported have an accuracy of the order of 25%. The values reported on the few samples of human tissue studied are different only to a small degree from the values found for the tissues of the dog. The values for Young's modulus ranged from 5.7×10^6 dynes/cm^2 for the transverse direction around the aortic arch to 110×10^6 dynes/cm^2 for the skin of the abdomen. The values for the breaking strength ranged from 3.3 to 44.4 kg/cm^2 for the same tissues. The breaking index ranged from 0.17 for the longitudinal direction of the midesophagus to 0.71 for the longitudinal direction in the same organ. Author

N64-22328 Chicago Medical School, Ill.

A STUDY OF THE EFFECTS OF ANESTHESIA, HIGH OXYGEN AND FEEDING UPON THE RESONANT FREQUENCIES OF VISCERAL ORGANS Technical Documentary Report, Apr.–30 Sep. 1962

John L. Nickerson Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs., Apr. 1964 18 p refs

(Contract AF 33(616)-7053)

(AMRL-TDR-64-14; AD-601180)

The purpose of this study was to determine the influence of anesthesia, the breathing of 100 percent oxygen, and the effects of having a full compared with an empty stomach on the resonant frequencies of thoracic and abdominal regions of the dog. The resonant frequencies were determined from photographs made with a specially designed X-ray kymograph. In the animals studied, the visceral contents of the thorax had resonant frequencies in the range of 3.8 to 7.4 cps with a mean value of 5.1 cps. There was no significant change in resonant frequencies in going from one to another of the conditions studied. There was some slight indication of a decrease in resonant frequency in the abdominal viscera when the stomach was filled with food as compared with the other conditions where the stomach was empty. The measured values of the amplitude magnification and damping for the regions studied are also presented.

Author

N64-22343 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RESULTS OF INVESTIGATIONS OF THE EFFECT OF IONIZATION RADIATION ON THE RETINA AND CERTAIN PHOTOSENSITIVE SYSTEMS

G. G. Demirchoglyan, M. A. Allakhverdyan, A. B. Melik-Musyan, V. G. Organjanyan, R. I. Pogosyan et al 18 Mar. 1963 16 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 2, no. 3, 1962 p 442–449

(FTD-TT-63-163/1+2+4; AD-401743)

The following methods were used in the study of the effect of ionizing radiation on the retina: electroretinography for recording electrical potential of the eye; microelectrode technique for recording the intraretinal potentials; amperemetric determination of the content sulfhydryl group in the retina; measurement of the absorption spectra of the visual pigment of the retina; and morphologic and histosensitivity of various photosensitive systems. To study the radiosensitivity of various photosensitive systems, biological specimens that had evolutionary eye structural differences were studied. The experimental results indicated that small doses of ionizing radiation were sufficient to affect the functional properties of the retina.

N.E.A.

N64-22352 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BERYLLIUM TOXICOLOGY, SYMPTOMATOLOGY OF AFFECTIONS AND INDUSTRIAL HYGIENE

V. M. Kozlov and V. D. Turovskiy 24 Oct. 1963 161 p refs Transl. into ENGLISH of the Book "Berilliy Toksikologiya, Klinika Porazheniy, Gigiyena Truda" Moscow, Gos. Izd. Lit. v Obl. At. Nauki i Tekhn., 1961 p 3–118

(FTD-TT-63-578/1+2; AD-429101)

This book describes the problems of the toxicology of beryllium, the symptomatology of affections caused by the action of this compound, industrial hygiene for beryllium production, and the protection of the environment from contamination with production wastes. Sanitary–hygienic requirements for the designing of production areas, for the various types of equipment used, and for industrial ventilation systems are given.

Author

N64-22363 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE VALUE OF FEEDING FACTORS IN PROPHYLAXIS OF RADIATION DISEASES (SELECTED ARTICLES)

18 Feb. 1964 25 p refs Transl. into ENGLISH from Znacheniye Faktora Litaniya v Profilaktike Luchevoy Bolezni, Trudy, Inst. Eksperim i Klinich. Med., Izd. Akad. Nauk Latv. SSR, no. 28, 1962 p 83–86, 117–128

(FTD-TT-63-1064/1+2+4; AD-432122)

Two areas of research are discussed: (1) a protein-vitamin complex suitable for alimentary prophylaxis of radiation sickness and (2) effect of gamma irradiation on the thiamine and riboflavin content in the liver and brain, and of vitamin B_{12} in the rat liver, depending on the nutritional value of their diet.

P.V.F.

N64-22365 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

REGIONAL HEMODYNAMICS INDICATORS AT VESTIBULAR LOADS

B. O. Nakhapetov 26 Feb. 1964 10 p refs Transl. into ENGLISH from Fiziol. Zhur., Akad. Nauk Ukr. RSR (Kiev), v. 9, no. 3, 1963 p 325–329

(FTD-TT-64-32/1+2; AD-432164)

The study of changes in regional indicators of blood circulation during vestibular stimulation at various functional states of a vestibular analyzer was investigated. Conclusions reached as a result of the investigation include the following: (1) Changes in arterial pressure during vestibular stimulation have phase characteristics, whereby the relationship of pressure rise and reduction phases are different in various vascular parts. (2) A valid dependence between the functional state of the vestibular apparatus and changes in arterial pressure after vestibular stimulation are not observed in healthy people. (3) Disruptions in vestibular–vegetative coordination are often accompanied by progressing reductions in oscillatory index, which may indicate a rise in vascular tonus. P.V.E.

N64-22372 Lockheed Missiles and Space Co., Sunnyvale, Calif.

BIONICS—A STUDY OF BIOLOGICAL RECEPTORS AND REGULATORS AND THEIR APPLICATION TO ENGINEERING DESIGN: AN ANNOTATED BIBLIOGRAPHY

Charlie M. Pierce, comp. Jun. 1963 218 p refs

(SRB-63-2; LMSC-6-90-63-66)

Bionics is a field of study that involves the chemical, electrical, or mechanical simulation of biological functions. Areas of application include automatic control systems, chemical engineering, computer design, detector design, and medicine. The scope of this bibliography encompasses living sensory perceptors, biological control systems, and their simulation. Emphasis has been placed on auditory perception. Visual perceptors are not covered in great detail, since knowledge in this area is relatively advanced. Most of the 515 references were published between January 1958 and June 1963. The references are grouped by subject topics and arranged according to the first author. Separate indexes for corporate author, personal author, and subject are included at the end of the bibliography. Author

N64-22373 Hine Labs., Inc., San Francisco, Calif.

A STUDY OF THE MECHANISM OF ACUTE TOXIC EFFECTS OF HYDRAZINE, UDMH, MMH, AND SDMH

Francis W. Weir, Jesus H. Nemenzo, Swanson Bennett, and Frederick H. Meyers Wright-Patterson AFB, Ohio, Aerospace Med. Res. Labs., Apr. 1964 32 p refs

(Contract DA-18-108-AMC-19-A)

(AMRL-TDR-64-26; AD-601234)

Four separate mechanisms of action are suggested by differences in pharmacologic activity. SDMH has a markedly delayed toxicity, in mice, as compared to the other hydrazines. MMH manifests its MAO inhibitory activity by intensifying the response to tyramine. Hydrazine convulsions are cortical in origin, whereas UDMH, SDMH, and MMH convulsions originate in a prepontine area. Protection from convulsions and death due to hydrazine is afforded, in mice, by arginine or ornithine. Protection is provided from the effects of both UDMH and MMH, in mice, by pyridoxine and amino-oxyacetic acid. The p-chlorobenzaldehyde and p-nitrobenzaldehyde protect against the effects of UDMH, but not MMH; p-dimethylaminobenzaldehyde protects against the effects of MMH but not UDMH. Author

N64-22382 Air Force Systems Command, Wright-Patterson AFB, Ohio Aerospace Medical Research Lab.

DONNING AND DOFFING THE "PHASE B" APOLLO PROTOTYPE SPACE SUIT DURING ZERO GRAVITY

Edwin H. Sasaki Apr. 1964 13 p ref

(AMRL-TDR-64-32; AD-601250) OTS: $0.50

Time scores were recorded of a subject donning and doffing a Phase B Apollo prototype space suit inside and outside a donning bag, while in the weightless condition. The total times for each of the three donning trials were, in order, 181 sec inside the bag, 165 sec outside the bag, and 154 sec inside the bag. Difficulties encountered in donning the suit are mentioned. The total time for the one doffing trial, inside the bag, was only 95 sec. Neither the bag nor the space suit was vented or pressurized for the tests. Author

N64-22390 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

IONIZING RADIATION AND METABOLISM

L. S. Cherkasova, K. B. Fomichenko et al 11 Jul. 1963 224 p refs Transl. into ENGLISH of the book "Ioniziruyushcheye Izlucheniye i Obmen Veshchestv" Minsk, Izd. An BSSR 1962 p 1–174

(FTD-TT-62-1575/1+2; AD-417407)

CONTENTS:

1. THE MECHANISM OF THE BIOLOGICAL REACTION TO RADIATION p 4–24 refs
2. INFLUENCE OF IONIZING RADIATION ON THE CENTRAL NERVOUS SYSTEM p 25–82 refs
3. INFLUENCE OF IONIZING RADIATION ON THE ENDOCRINE SYSTEM p 83–102 refs
4. INFLUENCE OF IONIZING RADIATION ON METABOLISM IN THE LIVER p 103–131 refs
5. INFLUENCE OF IONIZING RADIATIONS ON BIOCHEMICAL CHANGES IN THE GASTROINTESTINAL TRACT p 132–141 refs
6. BIOCHEMICAL CHANGES IN THE MUSCLES UNDER THE ACTION OF IONIZING RADIATIONS p 142–168 refs

N64-22412 Cedars of Lebanon Hospital, Los Angeles, Calif.

THE COMMON ORIGIN OF PRECORDIAL VIBRATIONS

Clarence M. Agress, Stanley Wegner, Daniel J. Bleifer, Alfred Lindsey, John Van Houten et al Repr. from Am. J. Cardiology, v. 13, no. 2, Feb. 1964 p 226–231 refs

(Grant NsG-289-62)

The historical development of precordial vibration recording techniques is reviewed, and the basic electronic principles are outlined. Animal experiments were performed, in which left ventricular pressure curves were obtained simultaneously with precordial vibration tracings. An analog computer was used to derive a tracing resembling the vibrocardiogram from the pressure curve; a Krohn–Hite filter was used to obtain an apexcardiogram, a phonocardiogram, and an accelerogram from the vibrocardiogram. It was demonstrated that a record closely resembling the left ventricular pressure tracing can be obtained by integration of the vibrocardiogram. The basic relationship of the precordial vibratory tracings to pressure changes within the left ventricle was demonstrated. Author

N64-22418 Maryland U., College Park.

RATE-CHANGE EFFECTS WITH EQUAL POTENTIAL REINFORCEMENTS DURING THE "WARNING" STIMULUS

Stanley S. Pliskoff Repr. from the J. Exptl. Analysis Behavior. v. 6, no. 4, Oct. 1963 7 p refs
(Grant NsG-189-61; Contract DA-49-193-MD-2288)

Two pre-schedule-change stimuli were superimposed on the same VI baseline and were thereby equated with respect to reinforcement potential. One such stimulus preceded a transition to an extinction schedule or a VI schedule of lower reinforcement frequency while the other preceded a transition to a VI schedule of higher reinforcement frequency. Response rate during the warning stimulus was greater preceding the transition to the lower reinforcement frequency than it was preceding the transition to the higher reinforcement frequency. That difference was often evidenced by an absolute increase and decrease in rate, in conformity with previous findings on the topic. The present experiment extends previous findings in several ways, including the presentation of quantitative estimates of the effects. Author

N64-22420* Pennsylvania State U., University Park Walker Lab.
THEORETICAL STUDIES ON LIVING SYSTEMS IN THE ABSENCE OF MECHANICAL STRESS
Ernest C. Pollard [1962] 19 p refs Presented at the AAAS Meeting, Philadelphia, 1962
(Grant NsG-182-62)
(NASA-CR-56482) OTS: $1.60 ph

The wisdom of sending up relatively small systems in satellites to study the effect of weightlessness was investigated. The following conclusions were reached: (1) Small single cells should show little effect of weightlessness. (2) Cells as large as 10μ across should show some effect due to the redistribution of mitochondria or the nucleolus. (3) Systems of cells in which relatively large objects, such as ribosomes, pass from cell to cell should show gravity effects. (4) Quite extensive systems, such as cells exceeding 1 cm in length should have increased membrane permeability at the lower end. This effect could be greatly increased if each cell had many internal membranes. (5) Experiments on weightlessness should also consider temperature as a variable. P.V.E.

N64-22425* Itek Corp., Palo Alto, Calif. Vidya Div.
AUSCULTATORY VERSUS DIRECT PRESSURE MEASUREMENTS FOR NEWTONIAN FLUIDS AND FOR BLOOD IN SIMULATED ARTERIES
A. H. Sacks, K. R. Raman, J. A. Burnell and E. G. Tickner 30 Dec. 1963 111 p refs
(Contract NAS2-1137)
(NASA-CR-56470; Vidya-119)

Experiments were performed in a large-scale simulated arterial-flow system to investigate the relationship between auscultatory and direct measurements of arterial blood pressure. Efforts were made to simulate the living system as closely as possible, and comparisons were made over a wide range of pulse rate, pulse amplitude, and mean pressure level, using as the fluid various mixtures of water and glycerol and, finally, whole blood. The results indicate that both the auscultatory systolic and diastolic pressure readings, as determined with a sphygmomanometer, are generally higher than the corresponding maximum and minimum of the oscillatory intra-arterial pressures. The process of occluding the artery for auscultation was generally found to amplify the oncoming pulse wave just proximal to (i.e., just ahead of) the pressure cuff, and to alter completely the form of the pulse wave as it passes through the cuff during the production of Korotkoff sounds. In studying the simulation of the blood fluid, it was found that whole blood behaves as a combination of a pseudoplastic and a Bingham fluid. P.V.E.

N64-22427* California U., Los Angeles Brain Research Inst.
PROLONGED EFFECTS OF LSD ON EEG RECORDS DURING DISCRIMINATIVE PERFORMANCE IN CAT; EVALUATION BY COMPUTER ANALYSIS
W. R. Adey, D. O. Walter, and T. S. Brown [1963] 24 p refs
(Grant NsG-203-62)
(NASA-CR-53832) OTS: $2.60 ph

The effects of LSD were studied in relation to changes induced in computed averages of epochs of EEG records during a discriminative task performance. Data were obtained from exposing 18 cats to LSD for a period of many months; the data presented are for 2 cats. LSD (75μg/Kg) was given in single doses by intraperitoneal injection at intervals of 3 to 6 weeks. Computed averages of thythmic hippocampal wave trains during approach performance showed an increase in amplitude and regularity following LSD, typically in the initial waves immediately following presentation of the situation. This modification was maximal 2 to 3 days after LSD, and decayed to control levels after 5 to 7 days. Similar analyses of record from the posterior pyriform (entorhinal) cortex indicated an increment in the early components of wave trains during discriminative performances, which also reached a maximum 2 to 3 days after LSD. Midbrain reticular activity showed only minor changes on days following LSD, also peaking about 4 days after drug dosage. P.V.E.

N64-22440* National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
AEROSPACE MEDICAL AND BIOENGINEERING CONSIDERATIONS IN LIFTING-BODY AND RESEARCH-AIRCRAFT OPERATIONS
Milton O. Thompson 11 May 1964 10 p Presented at the 35th Aerospace Med. Assoc. Ann. Meeting, Miami Beach, Fla., 11–14 May 1964
(NASA-TM-X-56005) OTS: $1.10 ph

A lifting-body research vehicle is being developed that will investigate supersonic, transonic, and subsonic flight regions. This vehicle will be full-scale in size and weight, will be launched from a B-52, and will require systems comparable to an operational-fighter aircraft or an X-15 research aircraft. The bioengineering considerations applicable to the lifting reentry vehicle as well as to the cockpit design, protective equipment, escape system, medical monitoring, and crew selection and evaluation are discussed. R.T.K.

N64-22506 IIT Research Inst., Chicago, Ill. Life Sciences Research Div.
EFFECTS OF SPACE CABIN ENVIRONMENTS ON RESISTANCE OF MICE TO INFECTION WITH KLEBSIELLA PNEUMONIAE
Bernard J. Mieszkuc and Richard Ehrlich Brooks AFB, Tex. School of Aerospace Med., Mar. 1964 12 p refs
(Contract AF 41(657)-351)
(SAM-TDR-64-9)

This study shows the effect of exposure of mice to an altitude of 35,000 ft and to an atmosphere consisting of approximately 85% oxygen, 10% carbon dioxide, and 5% nitrogen for 3, 7, 14, and 30 days on susceptibility to respiratory infection caused by aerosols of Klebsiella pneumoniae. Mice exposed to 35,000 ft for 14 days prior to challenge and then returned to 35,000 ft exhibited an increase in mortality from 37% to 53%. There was an increased neutrophilic percentage accompanied by a lower white cell count in the blood of mice exposed to 35,000 ft for 14 days. Mice lost weight initially when placed at 35,000 ft. They started gaining weight after about 2 weeks, and the rate of weight gain was approximately that of mice kept at ambient altitude. Mice kept at 35,000 ft consumed more food than mice kept at ambient altitude. Author

N64-22646 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

CONCERNING THE QUESTION OF MECHANISM OF ACTION OF AN IRRADIATED THYROID GLAND ON THE CEREBRAL CORTEX

I. N. Kondratev 11 Feb. 1964 10 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 2, no. 4, 1962 p 569–572

(FTD-TT-63-231; AD-410929)

The bioelectric activity of visual and parietal regions of the cerebral cortex of 19 mature male rabbits weighing 1.8 to 2.5 kg each was studied. Two series of experiments were conducted. In the first, the intact thyroid glands were subjected to irradiation, and in the second, the denerved thyroid glands were subjected to irradiation. Investigation of dioelectric activity and recording of heart contractions were made before irradiation, again in 30 minutes, and then 3 hours after irradiation. Two to three hours after irradiation, an increase of the level of bioelectric activity and quickening of the heart contractions occurred in the rabbits with intact thyroids. In the animals with denerved glands, the reactions were sharply weakened or completely absent. P.V.E.

N64-22652 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ACUTE RADIATION INJURIES AND THEIR TREATMENT

I. M. Poltavets, F. F. Sinitsyna et al 15 Oct. 1963 180 p refs Transl. into ENGLISH from the Book "Ostryye Radiatsionnyye Porazheniya i Ikh Lacheniye" Kiev, Gos. Med. Izd. USSR, 1962 p 3–155

(FTD-TT-63-610/1+2; AD-429452)

This book describes methods of treating acute radiation injuries, the therapy of patients with radiation injuries, and the pathologoanatomical changes that occur in the body during this illness. The classification and evaluation of casualties in a focus of mass injury and the organization of dosimetric monitoring in the medical establishments and institutions are described, the latest data being taken into account. Author

N64-22665 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF TRANSVERSE ACCELERATION ON OXYGEN TENSION IN BRAIN TISSUE

Ye. A. Kovalenko, V. L. Popkov, and I. N. Chernyakov 16 Jan. 1964 12 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR, (USSR), v. 49, no. 10, 1963 p 1145–1149

(FTD-TT-63-1215/1+2+4; AD-430032)

During a gain of acceleration and during deceleration of a vehicle, a living organism is subjected to the unfavorable effect of prolonged g-forces. The degree and character of pathological disorders in the organism in many cases are determined by the position of the body relative to the direction of the g-forces. During transverse accelerations, when considerable values are attained and act for a long time, disorders mainly associated with impairment of the function of external respiration and blood circulation develop in the organism. From the study of the oxygen tension (pO_2) of the brain tissue, the following results were recorded: (1) The average level of pO_2 during accelerations of 2 to 4 g was close to the starting level; during 6 g, it started to decrease (90%); during 8, 10, and 12 g, it was 86%, 81%, and 76% of the starting level, respectively. (2) During the initial period of rotation of the animal with accelerations of 2, 4, and 6 g, an increase of pO_2 in the brain tissue above the starting level was noted; during rotation of anesthetized dogs on a centrifuge, a similar increase of pO_2 was not noted. (3) When the head is fixed above the trunk, the transverse accelerations produced a more expressed fall of the oxygen tension in brain tissue than when the head was fixed on a level with the trunk. J.L.D.

N64-22697 Aerospace Medical Div. Aeromedical Research Lab. (6571st)., Holloman AFB, N. Mex.

TRAINING TECHNIQUES FOR THE CONTINUOUS AVOIDANCE TASK WITH CHIMPANZEES

Donald N. Farrer and Marvin E. Grunzke May 1964 17 p refs (ARL-TDR-64-7; AD-430496)

A new training technique for teaching chimpanzees to perform the continuous avoidance task is described and compared to the traditional method of obtaining this performance from chimpanzees. The new technique was accomplished with five young chimpanzees, and the results were compared to the previous method. It was concluded that the time required to obtain stable performance was within the same limits of variability due to individual differences, but the number of shocks were substantially reduced. Author

N64-22705 Naval School of Aviation Medicine, Pensacola, Fla.

DETERMINATION OF FIRE HAZARD IN A FIVE PSIA OXYGEN ATMOSPHERE

Arthur L. Hall and Hwai S. Fang 1 Sep. 1963 17 p refs (Rept.-4; AD-424009)

The possibility of hazardous external fire in a physiologically tolerable breathing atmosphere of 5-psia oxygen was investigated as compared to that existing in an atmosphere of sea-level pressure. In air at sea-level pressure, paper burned, and nylon, neoprene, and vinyl plastic melted. Skin of an exposed rat was singed. A toweling smother device extinguished the burning paper in one-fourth second. In the 5-psia-oxygen atmosphere paper ignited at a lower temperature and burned approximately six times as fast. The other materials also burned, as did exposed rats, which were burned over their entire body. The toweling burst into flame within one-half second. Author

N64-22711 Federal Aviation Agency, Oklahoma City, Okla. Civil Aeromedical Research Inst.

BIOMEDICAL RESEARCH STUDIES IN ACCELERATION, IMPACT, WEIGHTLESSNESS, VIBRATION, AND EMERGENCY ESCAPE AND RESTRAINT SYSTEMS: A COMPREHENSIVE BIBLIOGRAPHY

Richard G. Snyder, John Ice, Judith C. Duncan, Alvin S. Hyde (AMRL), and Sidney Leverett, Jr., (School of Aerospace Med.) Dec. 1963 3088 p refs Sponsored in Cooperation with Aerospace Med. Div. and School of Aerospace Med.

(Contract DO-33(657)62-382)

(CARI-63-30; AD-601531)

The bibliography attempts a comprehensive listing of all scientific research in the areas of acceleration, vibration, deceleration, weightlessness, and protection and survival research. Scope of the fields surveyed includes rather broad areas of prolonged acceleration including blast and impact, vibration, weightlessness, and restraint and escape systems including capsules, ejection, and evacuation. Materials appearing as early as 1818 and as late as November 1963 are covered. Author

N64-22719 Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.

TRANSPOSITION AS A FUNCTION OF THE NUMBER OF TEST TRIALS

Gloria T. Chisum 19 May 1964 16 p refs

(NADC-ML-6404; AD-601374)

Forty-two female hooded rats were trained to discriminate between two stimuli, and then were tested for transposition on pairs of stimuli that were varying distances from the training stimuli. Subjects that failed to transpose immediately did so as testing under nondifferential reinforcement continued. The results agree with the adaptation level interpretation, but do not agree with an S-R or a relational interpretation. Author

17 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and materials fabrication, handling and inspection. *For related information see*: 06 Auxiliary Systems.

N64-21563 General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility
EFFECTS OF REACTOR RADIATION ON CERAMIC-BONDED SOLID-FILM LUBRICANTS
F. A. Haley and R. H. McDaniel 30 Aug. 1963 28 p refs
(Contract AF 33(657)-7201)
(NHRF-63-6T; MR-N-302; AD-417167)

Two solid-film lubricant formulations ($PbS + MoS_2 + B_2O_3$ and MoS_2 + graphite + sodium silicate) have been exposed to reactor radiation and tested for wear life on a Hohman A-6 wear tester. Substrate material was Inconel X, rub shoes were of Rex AAA, load per shoe was 110 lb, and sliding speed was 128 fpm. Several test temperatures up to 1,200° F were employed. It was concluded that a gamma dose of 1.47×10^{11} ergs/gm(C) and a neutron flux of 2.85×10^{16} n/cm^2 (E>2.9 Mev) had no significant effect on the wear life of these films. Author

N64-21571 Battelle Memorial Inst., Columbus, Ohio
A STUDY OF THE INERTIA PUMP FOR USE IN THE EXTRATERRESTRIAL ENVIRONMENT
J. W. Kannel, D. H. Thiel, W. C. Franke, and E. M. Simmons Apr. 1963 68 p refs
(Contract AF 33(657)-8463)
(ASD-TDR-63-374; AD-600756)

A program of study was conducted to determine the feasibility of using an inertia pump, which does not require dynamic seals, rather than more conventional systems for the transfer of various fluids in space. This study includes evaluations of possible fluids to be transferred in space, the suitability of the inertia pump to transfer these fluids, a layout design of an extraterrestrial inertia pump, and a theoretical analysis of this pump. Two fluids that will be used in space are cryogenic liquids and liquid metals. An inertia pump capable of delivering the flow rates desired for the transfer of cryogenic liquids in space appears to be larger than a centrifugal pump of comparable capacity, which makes it somewhat unattractive for this application. However, it does appear practical as an extraterrestrial liquid-metal pump. The weight of a liquid-metal inertia pump should be quite competitive with the weight of mechanical liquid-metal pumps and lighter than electromagnetic pumps with the same capacities. A layout design of a liquid-metal inertia pump was made. Various components incorporated in this design will require experimental evaluations. The theoretical analyses of the pump indicate that it should perform effectively and efficiently. Author

N64-21574 Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Labs.
STUDY ON THE FEASIBILITY OF APPLYING ULTRASONIC ENERGY TO THE ROLLING PROCESS FOR SHEET METALS First Bimonthly Progress Report, 6 Feb. 1964-6 Apr. 1964
James W. Cunningham [1964] 13 p refs
(Contract NOw 64-0294-J)
(AD-438937)

Two effects are anticipated from the use of ultrasonics in rolling: a possible reduction of yield strength and reduced friction in the roll gap. The relative magnitude of these effects and their relation to rolling variables will determine the experimental program. Design problems in the construction of a transducerized roll were analyzed and an experiment to solve them initiated. Author

N64-21598 Melpar, Inc., Falls Church, Va.
2000° F POWER WIRE FOR AEROSPACE ENVIRONMENT Fourth Quarterly Report, 5 Jan.-5 Apr. 1964
[1964] 17 p
(Contract AF 33(657)-11046)
(AD-434587)

One of the 22-gage power-wire systems passed the 1,200-v breakdown test at 2,000° F. Quantity production of systems to meet this specification, however, was difficult, apparently because the end seals are slightly undersized. Therefore, larger-diameter end seals will be inserted into future systems. The replacement of copper with rhodium plating on the metalizing greatly enhanced the appearance of the braze joints. Author

N64-21608 Argonne National Lab., Ill.
A PULSED ELECTROMAGNETIC TEST SYSTEM APPLIED TO THE INSPECTION OF THIN-WALLED TUBING
C. J. Renken Mar 1964 18 p refs
(Contract W-31-109-ENG-38)
(ANL-6728) OTS: $0.50

The most active test problem in the nuclear field to which electromagnetic test methods can be applied at present seems to be the inspection of small-diameter, thin-walled tubing usually used for fuel-element jackets, instrument-lead protection, or heat-exchanger applications. Such material is generally nonferromagnetic and is often limited to wall thickness below 1.25 mm by the requirements of heat transfer through the tube wall. Quality requirements for tubing intended for these applications are very strict, and some type of nondestructive test is generally valuable or even absolutely essential. There is a considerable range of tube wall thicknesses over which both electromagnetic and ultrasonic methods are applicable. The inspection of tubes below 5.8 mm by ultrasonic methods is plagued by formidable alignment problems; on the other hand, it becomes difficult to maintain a defect sensitivity of 10% of the wall thickness by electromagnetic tests on tubes with over 0.64-mm wall thickness. In certain cases, noise in the tube caused by nondeleterious dimensional or metallurgical variables may produce a clear advantage of one method over another. This report explores the possible application of pulsed fields to electromagnetic testing and suggests test systems that would exploit some of the advantages of pulsed field operation. Author

N64-21612 Joint Publications Research Service, Washington, D.C.
SHIPBUILDING IN COMMUNIST CHINA

9 Apr. 1964 198 p refs Transl. into ENGLISH of Selected Articles from Chung-Kuo Tsao-Ch'uan. (Shanghai), no. 1, 3, and 4, 1963
(JPRS-24122; OTS-64-31038) OTS: $3.00

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1. LINEARIZED THEORY FOR TWO-DIMENSIONAL FULLY CAVITATED HYDROFOIL S.-T. T'ung p 1–42
2. STATIC CHARACTERISTICS OF HYDROFOIL CRAFT Y.-S. Ho p 43–55
3. MANEUVERABILITY OF JET PROPULSION SHIPS H.-H. Wu p 56–75 refs
4. FORECASTING METHOD FOR PERFORMANCE CURVE AND ITS POINTS OF VARIABLE WORKING CONDITIONS OF THE TURBINE-SUPERCHARGED TWO-STROKE DIESEL ENGINE Y.-H. Wang p 76–109 refs
5. THEORY AND ANALYSIS OF VERTICAL-BLADE PROPELLER CHARACTERISTICS H.-N. Ch'ien p 110–146 refs
6. A NEW METHOD FOR APPROXIMATE CALCULATION OF VISCOUS RESISTANCE ON A SHIP WITH SMOOTH HULL C.-M. Yang p 147–158 refs
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N64-21648 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PROTECTION OF NIOBIUM FROM HIGH-TEMPERATURE GAS CORROSION

A. I. Borisenko 12 Feb. 1963 58 p refs Transl. into ENGLISH of the book "Zashchita Niobia ot Vysokotemperaturnoy Gazovoy Korrosii" Moscow, Izd. Akad. Nauk SSSR, 1961 p 1–40
(FTD-TT-62-1251/1+2; AD-299659)

The causes of the intense oxidation of niobium and its alloys, which may be prevented by applying protective surface coatings that insulate the metal from a gaseous medium, are analyzed. Means of protecting niobium from oxidation are cited, and their subsequent development is projected. Author

N64-21675 Arde-Portland, Inc., Paramus, N.J.

CRYOGENIC STRETCH-FORMING OF SOLID-PROPELLANT ROCKET CASES Quarterly Report No. 7, Dec. 1, 1963–Feb. 28, 1964

R. H. Alper [1964] 15 p
(Contract DA-30-069-ORD-3501)
(QR-7; AD-434892)

Mechanical stretching of nozzle end rings was successfully completed. A total of 17 usable rings was produced. Tensile tests of material from a ring showed yield strengths of from 214,000 to 224,000 psi, indicating that mechanical cryogenic stretching is an effective production process for making high-strength structural members of heavy cross section from austenitic stainless steel. Three of the vessels stretched previously were machined to accept rough-machined end rings. One additional vessel was aged, and final dimensions were taken to determine if aging caused distortion of the vessel. The measurements taken indicated that aging is a very practical process for the strengthening of cryogenically stretched vessels to levels over 290,000 psi, inasmuch as no change in vessel dimensions occurs. Author

N64-21678 Picatinny Arsenal, Dover, N.J. Ammunition Engineering Directorate

LINEAR PROPORTIONAL CONTROL HOT GAS VALVE FOR SECONDARY INJECTION

W. F. Lehman and E. P. Crommie Feb. 1964 39 p refs
(TR-3137; AD-433751)

Two linear proportional-control hot-gas valves were tested as an integral component of a liquid rocket chamber bleed system. Both valves featured proportional control by means of positioning a truncated conical pintle within the flow control orifice of the seat assembly. However, they varied in the designs employed to withstand the high temperature erosive gas flow. One valve relied entirely on the refractory metal, tantalum–tungsten alloy (Ta-10W), whereas the second valve used an arrangement of internal heat sinks, ceramic insulators, and ablative plastic inserts to serve as thermal protection for the tungsten surfaces of the critical components. The refractory metal valve failed after 3 sec of operation due to severe degradation of the TA-10W alloy components. In contrast, the composite materials valve successfully completed four 12-sec-duration tests, representing 48 sec of accumulative throttling operation without any parts replacement. The valve demonstrated excellent structural durability and reproducible control capability during cyclic throttling. Author

N64-21691 SKF Industries, Inc., King of Prussia, Pa. Engineering and Research Center

INFLUENCE OF LUBRICATION ON ENDURANCE OF ROLLING CONTACTS Progress Report No. 9, Sep. 22–Dec. 22, 1963

E. F. Brady, J. A. Martin, R. J. Riedy, W. Schmidt, A. J. Schwartz, and L. B. Siblex [1963] 52 p refs
(Contract NOw-61-0716-C)
(AL-64T014; AD-439606)

Lubrication studies using radiotracer techniques and electrical conductivity measurements developed previously have been continued, using a rolling four-ball test machine. Data on several lubricants under different operating conditions are reported. The development of high-resolution autoradiography techniques is described, and the results of a brief study of wear particle size in the rolling four-ball tester are given. Also given is progress in the development of a dynamic two-ball tester for the study of film thickness and lubrication effects on contact stresses at rolling contacts, using X-ray beam techniques. Author

N64-21693 Joint Publications Research Service, Washington, D.C.

VIBRATION FINISHING OF EDGES OF PUNCHED PARTS

Yeh K'o-wu and Li Chin'chih 5 May 1964 21 p Transl. into ENGLISH from Shang-hai Chi-hsieh (Shanghai), no. 4, 25 Apr. 1963 p 4–9
(JPRS-24468; OTS-64-31200) OTS: $0.50

Vibration finishing uses the jig and fixture to remove excess dimensions for parts tolerance in a special press by applying high-frequency (1,200 to 2,000 vibrations per minute) and low-frequency amplitude (0.05 to 0.6 mm) of vibration pressure. It is assumed to be of value in the production of computer parts. The most important problem in vibration finishing is the precision manufacturing of the jig and fixture. A.W.

N64-21739 Hanford Atomic Products Operation, Richland, Wash.

CERAMICS RESEARCH AND DEVELOPMENT OPERATION Quarterly Report, Oct.–Dec. 1963

[1963] 117 p refs
(Contract AT(45-1)-1350)
(HW-76304) OTS: $2.50

Included in the Ceramics Research Program are studies on the properties and composition of reactor-fuel-element materials, radiation effects on ceramic materials, and fabrication and properties of cermets. In the Fuels Development

Program, various fuel-element cladding processes and materials are discussed. In the Fuels Testing and Analysis Section, irradiation testing and performance studies of fuel elements for the Plutonium Recycle Test Reactor and the Experimental Boiling Water Reactor are described. D.S.G.

N64-21753 Philco Corp., Lansdale, Pa.
PEM FOR GOLD-DOPED GERMANIUM INFRARED DETECTOR TYPE IR400
R. J. Roode [1963] 46 p
(Contract DA-36-039-AMC-01464(E))
(QPR-4; AD-431917)

This report discusses research on a PEM for producing p-type, gold-doped germanium-infrared detectors, type IR400. Work was concentrated on manufacturing and testing of preproduction samples; compilation of the inspection and quality control plan; and preparation of processing specifications with device, jig, and fixture drawings. Five detectors, with barium fluoride windows and sensitive area of 2 mm × 2 mm, were prepared as preproduction samples. Most samples met the original specification of $3 \times 10^9 \text{cm(cps)}^{1/2}/\text{watt}$; detailed test data are are included. Author

N64-21782 Picatinny Arsenal, Dover, N.J.
HERMETIC SEALING OF PROPELLANT CONTAINERS BY PRESSURE WELDING
Charles Zglenicki and Louis Silberman Mar. 1964 19 p ref
(TM-1373; AD-434175)

Pressure welding is the joining of metallic surfaces by application of compressive force alone. No heat is applied to effect a weld by this method. Efficient joints as strong as or stronger than the metals being joined may be had. Weld area strength is actually improved as a result of the cold working. The process is limited to nonferrous metals. However, dissimilar metals can be welded to each other. Metallurgical bonds are generally achieved if the metal surfaces to be welded are free of oxides and other contamination and sufficient pressure is used. The process was investigated as a means of hermetically sealing propellant in metal containers. Commercial smokeless powder was sealed in containers and tested for possible degradation after standard exposure tests. This report describes the procedures followed in sealing the containers and subsequent testing. Author

N64-21862 Joint Publications Research Service, Washington, D.C.
SOVIET RESEARCH IN WELDING
4 Jun. 1964 37 p refs Transl. into ENGLISH of 3 articles from Russian Periodicals
(JPRS-24940; OTS-64-31411) OTS: $1.00

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1. INFLUENCE OF THE CONDITION OF THE ELECTROSLAG PROCESS ON THE MELTING SPEED OF HEAVY-GAGE ELECTRODES D. A. Dudko, I. N. Rublevskiy, and G. S. Tyagun-Belous p 1–9 refs (See N64-21863 15-17)
2. ON DROP TRANSFER OF ELECTRODE METAL DURING ELECTROSLAG WELDING D. A. Dudko and I. N. Rublevskiy p 10–22 refs (See N64-21864 15-17)
3. METHODS OF WELDING TITANIUM IN CHEMICAL MACHINE BUILDING V. A. Toropov and L. P. Kolosova p 23–34 (See N64-21865 15-17)

N64-21863 Joint Publications Research Service, Washington, D.C.
INFLUENCE OF THE CONDITION OF THE ELECTROSLAG PROCESS ON THE MELTING SPEED OF HEAVY-GAGE ELECTRODES
D. A. Dudko, I. N. Rublevskiy, and G. S. Tyagun-Belous *In its* Soviet Res. in Welding 4 Jun. 1964 p 1–9 refs Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 12, Dec. 1958 p 57–62 (See N64-21862 15-17) OTS: $1.00

The dependencies of the melting coefficient of a heavy-gage electrode, made of rimming steel, upon the conditions of the electroslag process (current, voltage, depth of slag bath, and diameter of the electrode) are presented. The melting coefficient of the electrodes increased with an increase of current and voltage and also with a decrease in the depth of the slag bath. The melting-coefficient increased with an increase in electrode diameter. The chemical composition of the electrode metal and slag had a considerable influence on the melting speed of the electrodes. I.v.L.

N64-21864 Joint Publications Research Services, Washington, D.C.
ON DROP TRANSFER OF ELECTRODE METAL DURING ELECTROSLAG WELDING
D. A. Dudko and I. N. Rublevskiy *In its* Soviet Res. in Welding 4 Jun. 1964 p 10–22 refs Transl. into ENGLISH from Avtomat. Svarka (Kiev), no. 4 Apr. 1958 p 24–31 (See N64-21862 15-17) OTS: $1.00

Oscillographic investigation of the drop transfer of electrode metal during electroslag welding was conducted. The dependencies between the frequency of the transfer of drops and the elements of the welding condition were established. The intensity of the metallurgic reactions in the drops of electrode metal depending upon the welding condition is evaluated. Author

N64-21865 Joint Publications Research Service, Washington, D.C.
METHODS OF WELDING TITANIUM IN CHEMICAL MACHINE BUILDING
V. A. Toropov and L. P. Kolosova *In its* Soviet Res. in Welding 4 Jun. 1964 p 23–34 Transl. into ENGLISH from Khim. Mashinostr. (USSR), no. 6, Nov.–Dec. 1963 p 23–31 (See N64-21862 15-17) OTS: $1.00

Various methods of titanium welding are discussed. Results indicate that: (1) The designing of welding units should be made with a consideration of the maximum use of automatic welding (gas-arc or under flux). (2) A more rational utilization should be made of butt-weld joints that permit maximum use of mechanized welding processes. Butt joints most closely approximate the properties of the basic metal. (3) The standards for assembling titanium parts under arc welding must be higher than those usually indicated in the technical specifications for the manufacture of equipment made of stainless steel. (4) It is expedient, where possible, for the joining of thin-walled elements (with a thickness of up to 2 millimeters each), to use contact roller and spot welding that do not require special protection of the objects being welded from the effects of the atmosphere. (5) It is expedient to use electroslag welding in the manufacture of designs (made of titanium) with a thickness of more than 30 millimeters. I.v.L.

N64-21913 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
TORSION OF ROUND SHAFTS WITH VARIABLE DIAMETER

Rudolf Sonntag 8 May 1964 40 p refs Transl. into ENGLISH by JPRS from Z. Angew. Math. Mech., v. 9, no. 1, 1929 p 1-22 (RSIC-179; AD-601023)

A simple approximation method is shown for the calculation of stress increases at the transition points of stepped or grooved shafts. The results of this method are well confirmed by the paper of Willers as well as by the author's experiments. This method depicts the actual conditions for practically all technically important cases with a completely sufficient accuracy, with an average error of less than ±5%. Higher computed maximum stresses will probably result for exceptionally abrupt transitions, i.e., in cases that are obviously dangerous and are in practice of minor interest only, apart from the fact that they can always be avoided. Author

N64-21932 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METAL-POLYMERIC FILMS ON FRICTION SURFACES OF DETAILS

M. L. Barabash, M. V. Korogodskiy, and A. S. Krayushkin 2 Jul. 1963 10 p refs Transl. into ENGLISH from the Book "Plastmassy v Mashinostroyenii i Proborostroyenii" Kiev, Gostekhizdat, 1961 p 359-366

(FTD-TT-63-564/1+2; AD-414910)

Two methods are presented: (1) for obtaining metal polymeric films containing film forming glyptal lacquer and epoxy resin base, plus fillers of colloidal metal; and (2) for applying such films on friction surfaces in order to replace worn details. Applying film that contains colloidal metal appears to be a new method of repairing worn (through friction) features, including heavily worn parts such as pistons and other components of automobile engines. P.V.E.

N64-21950 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A METHOD OF DIE-FORGING UNDER PRESSURE

V. A. Khoruzhiy 27 May 1963 4 p Transl. into ENGLISH from Soviet Patent no. 150085, 25 Mar. 1961 p 1-2

(FTD-TT-63-567/1+2; AD-409945)

The method described of die-forging by pressure is distinguished by the fact that it secures reliable sealing by simultaneously subjecting two billets to the press. These billets, which have been welded together along the edges, are subjected to the press and, at the same time, liquid under pressure is injected between the billets. R.T.K.

N64-21954 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Division

DEFECTS OF PRESS CASTINGS AND METHODS FOR THEIR PREVENTION

E. S. Stebakov and V. Ya. Tarutin 22 Jul. 1963 29 p Transl. into ENGLISH of Chapter 8 from the Book "Lit'e Vyzhimaniyem" Moscow, Gos. Nauchno-Tekhn. Izd. Mashinostr. Lit., 1962 p 96-110

(FTD-TT-63-713/1+2; AD-412879)

This report presents a new technological process of producing thin-wall castings such as large panels. The first part of the report describes the technological principles of the process and several types of squeeze casting machines and appliances. The second part explains the basic hydrodynamics of viscous liquids and the hydrodynamics of the process. Examples of the application of hydrodynamics to the squeeze process are given. N.E.A.

N64-22041 Case Inst. of Tech., Cleveland, Ohio

SYNTHESIS OF A SIMPLE SHOCK ISOLATOR

Lucien A. Schmit, Jr., and Richard L. Fox Washington, NASA, Jun. 1964 58 p refs

(Grant NsG-110)

(NASA-CR-55) OTS: $1.50

The simple spring-mass-damper system is considered as a shock isolating system. The problem is to determine the spring stiffness, k, and the damping coefficient, c, for optimum performance. Specifically this note reports a successful method for solving both of the following problems: (1) The "rattle space" is limited by external considerations, and the problem is to choose the spring-damper combination such that the maximum acceleration is a minimum and such that the maximum relative displacement is consistent with the "rattle space." (2) The "fragility level" of the mounted unit is known, and the problem is to choose the spring-damper combination such that the maximum relative displacement is a minimum, and the maximum acceleration is less than the fragility level of the unit. These problems can be solved when the shock environment consists of either a single shock pulse or of several shock pulses. Author

N64-22058 Argonne National Lab., Ill.

A SHIELDED ENCLOSURE FOR NEUTRON RADIOGRAPHIC INSPECTION OF ENCAPSULATED, IRRADIATED SPECIMENS

W. N. Beck and H. Berger Mar. 1964 13 p refs

(Contract W-31-109-ENG-38)

(ANL-6799) OTS: $0.50

An existing shielded cask was modified to handle a complete irradiation experiment from the CP-5 reactor. The inspection technique makes use of a potentially radioactive screen to detect the neutron imaging beam after it has passed through the inspection object. The radioactive image on the screen is made visible by allowing it to decay in close contact with photographic film. Contrast resolution of the system is 0.76 mm (0.030 in.) or better. Contrast sensitivity is in the order of 1 to 2 percent. Author

N64-22114 Argonne National Lab., Ill.

SOME APPLICATIONS OF SCINTILLATION SPECTROMETRY TO NONDESTRUCTIVE TESTING

Ronald B. Perry Mar. 1964 15 p refs

(Contract W-31-109-ENG-38)

(ANL-6743) OTS: $0.50

Gamma-ray scintillation spectrometry is a useful tool for the nondestructive assay of the U^{235} content of research reactor fuel. The U^{235} is the only isotope of uranium that produces a strong peak of gamma energy at 184 Kev. Accordingly, the U^{235} content of reactor fuel can be accurately determined by counting the 184-Kev gamma emission. Uranium foil standards of known weight and isotopic content can be used for assay of fabricated reactor fuel with a product of density and thickness small enough to permit accurate measurement of the self-absorption factor. Two techniques for nondestructive assay of fabricated fuel in flat configurations, based on the use of uranium foils as standards, are discussed. In the first method a small area is counted and homogeneity is assumed. In the second method, a two-dimensional scanning technique is employed such that the entire sample is counted. A similar scanning technique has been used for tubes of 5.08- to 7.62-cm diameter. Author

N64-22121 Bureau of Mines, College Park, Md.

PREPARATION OF THICK COATINGS OF TUNGSTEN

F. X. Mc Cawley, C. B. Kenahan, and David Schlain 1964 33 p refs
(BM-RI-6454)

The electrodeposition of protective coatings of tungsten from a sodium and lithium borate–tungstate–tungstic oxide fused salt electrolyte was investigated. Soluble tungsten anodes were employed. Deposits were made on molybdenum, Carpenter 20 stainless steel, Inconel, and nickel. An atmosphere of argon was maintained around the electrolytic cell, and the electrolyte was stirred by rotating the cathode. Thick deposits of tungsten (up to 26 mils) were made at a temperature of 900° C and cathode current densities of 0.3 to 0.4 amp/in.^{2} with high current efficiencies. The effects of variations in temperature, current density, electrolyte agitation, and tungstic oxide content of the electrolyte and of the presence of impurities such as moisture, air, iron, and nickel were investigated. Author

N64-22150 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INSTALLATION FOR REMOVING SINTER FROM THE SURFACE OF A STEEL HOT-ROLLED BAND WITH ABRASIVE MATERIAL
V. A. Kolenko, L. A. Yutkin, A. D. Kuz'min, V. A. Novakov, and I. A. Aronov 29 Oct. 1962 5 p Transl. into ENGLISH from Soviet Patent 114646, Appl. no. 591013/48a, 103, 28 Jan. 1958 p 1–3
(FTD-TT-62-1291/1+2; AD-292207)

An installation is described for removing sinter from the surface of a steel hot-rolled band by abrasive material, by means of cavitation and hydraulic hammers activated by pulses of high-voltage discharges. This apparatus is designed so that its purpose of transferring the abrasive pulp along the surface of the band to be cleaned is accomplished in a metallic bath, in which spark dischargers are arranged with reflectors. Positioning of the band in the bath is accomplished by sockets located on top of the band. Rollers propel the band through the bath. Armature pipes cross the bath and protect the high-voltage cable. M.P.G.

N64-22166 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METHOD OF CLEANING ROLLED MATERIAL OF SCALE
L. A. Yutkin and L. I. Gol'tseva 30 Oct. 1962 4 p Transl. into ENGLISH from Soviet Patent no. 114172, 12 Nov. 1962 p 1–2
(FTD-TT-62-1295/1; AD-292181)

A method is presented for cleaning scale off rolled material that uses electrohydraulic shocks. An abrasive material that is introduced into the liquid bath where the electrohydraulic shocks occur intensifies the scale-removing process. R.T.K.

N64-22173 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE INFLUENCE OF INTERPHASE SURFACE ENERGY ON WETTABILITY
Yu. V. Naydich *In its* Problems of Powder Metallurgy and the Strength of Materials (Selected Articles) 10 Sep. 1962 p 8–17 refs (See N64-22171 15–18)

The properties of an equation for determining the wetting angle and the wettability of a solid phase by a liquid were studied. The relationship between the wetting angle and the interface energies under various experimental and production-process conditions are analyzed. It was found that when surface energy at the liquid–gas boundary (σ_{zh}) changes with a change in the liquid itself, the wetting angle decreases with decreasing σ_{zh}, and increases when σ_{zh} increases. From this it is concluded that in order to obtain the greatest wettability of any solid surface when the adhesive properties of the liquid–solid system are unknown, it is preferable to select the liquid with the lowest surface tension. It is also concluded that the magnitude of the solid-phase surface energy cannot, generally, serve as a criterion for selection of a solid material in order to obtain a definite degree of wettability by a given liquid. P.V.E.

N64-22176 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POTENTIOSTAT IN METALLOGRAPHY
Vladimir Cihai, Milan Prazak, and Miroslav Holinka 3 Mar. 1964 17 p refs Transl. into ENGLISH from Hutnicke Listy (Prague), v. 13, no. 6, 1958 p 496–501
(FTD-TT-64-19/1+2; AD-435509)

This report discusses the following: (1) the characteristics of a potentiostat (a device for controlling potential); (2) the use of a potentiostat for differential electrolytic etching; (3) the significance of the polarization curve of an alloy; (4) the selection of an etching potential according to the ratio of differentiation (the ratio of dissolving of the investigated phase and the remaining phases); (5) etching of anticorrosive steel; and (6) the polarization curves of anticorrosive steel and Fe-Cr alloys. I.v.L.

N64-22229 Martin Co., Denver, Colo.
TRANSIENT TESTS OF THE YLR 87-AJ-5 ROCKET ENGINE TURBOPUMP WITH THE REDESIGNED FUEL PUMP AND ASSOCIATED PROPULSION EQUIPMENT
R. H. Brown, R. H. Fashbaugh, and T. C. Shupert Mar. 1964 58 p
(Contract AF 04(647)-576)
(AD-434861)

Empirical test data on the redesigned fuel pump were obtained. Suction pulsing and discharge pulsing test methods were used. Essentially, the same suction pressure–amplitude ratio was exhibited by both fuel pumps. A Titan II system stability analysis gave these results: (1) With an oxidizer system having no attenuating devices, use of the redesigned fuel pump resulted in a more stable system. (2) With an oxidizer system with the lossy line, use of the redesigned fuel pump resulted in a less stable system. Therefore, the overall system stability, with the redesigned fuel pump or with the production pump, is also dependent on the oxidizer-system configuration. R.T.K.

N64-22242 Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ANALYSIS OF STRESS AND STRAIN IN SPHERICAL SHELLS OF PYROLYTIC CARBON
J. W. Prados and J. L. Scott Jun. 1964 54 p refs
(Contract W-7405-ENG-26)
(ORNL-3553) OTS: $1.25

A technique was developed for calculating profiles of the tangential stress and strain components that occur in spherical pyrolytic carbon shells as a result of thermal expansion or radiation-induced dimensional changes. The method is based on a mathematical analysis of stress and strain in a spherically symmetric, anisotropic medium having hexagonal symmetry in which the crystallographic axes coincide with axes of geometrical symmetry. The results should be of value in the development of pyrolytic carbon-coated reactor fuel particles, particularly for the selection of optimum design parameters and for the planning and interpretation of failure tests. A digital computer program was prepared for calculating tangential stress and strain profiles in particle coatings and plotting them as a function of position. The results of thermal stress calculations are presented for pyrolytic carbon coatings of three

different thicknesses at temperatures below and above the deposition temperature. Author

N64-22244* Westinghouse Electric Corp., Lima, Ohio Aerospace Electrical Div.
RESEARCH AND DEVELOPMENT PROGRAM ON MAGNETIC, ELECTRICAL CONDUCTOR, ELECTRICAL INSULATION, AND BORE SEAL MATERIALS Second Quarterly Report, Dec. 1, 1963–Feb. 29, 1964
P. E. Kueser et al Mar. 1964 181 p
(Contract NAS3-4162)
(NASA-CR-54041; WAED-64.14E) OTS: $13.00 ph

Mechanical tests were initiated on magnetic materials. Cube-textured materials showed a variation in Poisson's ratio depending upon the orientation of the measurement in respect to the crystal lattice. Hiperco 27 was tested at elevated temperatures in both argon and air atmospheres, and no significant difference in tensile or creep properties was observed. A number of organic and inorganic insulation materials are presented; these include most configurations suitable for electric apparatus. A new conductor, beryllia dispersion-strengthened copper, was fabricated. It exhibits stress-rupture properties a factor of four better than beryllium–copper No. 10 at elevated temperature. Beryllium–copper is presently one of the better high-strength, high-conductivity materials available. The bore seal effort has been focused on the development of metalized ceramic-to-metal sealing systems prior to their planned alkali–metal exposure tests. Author

N64-22247 Phillips Petroleum Co., Idaho Falls, Idaho Atomic Energy Div.
SAFETY ANALYSIS REPORT-SNAPTRAN 2/10A-3 WATER IMMERSION TESTS
F. L. Bentzen and T. M. Waage, ed. Mar. 1964 130 p refs
(Contract AT(10-1)-205)
(IDO-16929, Rev. 1); OTS: $2.50

The SNAPTRAN 2/10A-3 series is directed toward a determination of the consequences of a nuclear accident approaching the maximum credible that would result from the immersion of a SNAP 2/10A reactor core in water. The report contains a description of the experimental program, a description of the reactor test package and control system, a discussion of the results of previous water immersion experiments, a discussion of the operating philosophy and test procedures, and an evaluation of the potential hazards attendant to the experimental program. The areas of consideration in the safety evaluation include materials handling, possible operator error and system failure, radiation levels associated with the various tests, and consequences of the maximum nuclear excursion. Author

N64-22282 Battelle Memorial Inst., Columbus, Ohio
ELASTOMERS FOR FUEL SYSTEMS CONTAINING MICROORGANISM-CONTROLLING ADDITIVES Summary Report, 1 Oct. 1962–31 Aug. 1963
C. W. Cooper, H. T. Kemp, R. M. Kell Wright-Patterson AFB, Ohio, Res. and Tech. Div., 31 Dec. 1963 79 p refs
(Contract AF 33(657)-9804)
(RTD-TDR-63-4195; AD-428886)

An investigation is being conducted to develop aircraft integral fuel tank coatings capable of resisting microbiological deterioration or growth. Jet-fuel microbial isolates were obtained and adapted to growth in contact with fuel and appropriate elastomers. Pure-culture microbial studies permitted selection of five of the more active polymer-degrading microorganisms. Environmental mixed-culture exposures of various coatings are underway, and all biocide-free coatings show some microbial growth attachment. A number of potentially effective biocides have been obtained and are currently being evaluated in a commercial two-part polyurethane coating. Aluminum corrosion tests are also underway in jet-fuel culture systems. In connection with this, the possible effect of biocides on aluminum is also being investigated. Author

N64-22292 Telecomputing Corp., San Diego, Calif. Narmco Research and Development
INTERLAMINAR SHEAR OF FILAMENT-WOUND REINFORCED PLASTICS Quarterly Progress Report 28 Jun.–30 Sep. 1963
Robert A. Elkin, Boris Levenetz, and Bud L. Duft Oct. 1963 11 p refs
(Contract N60921-7094)
(QPR-1; AD-422174)

Several potential methods of improving interlaminar shear strength were investigated. The test specimens were filament-wound rings. Plans for fabrication, testing, and evaluation of cylindrical test specimens are presented. An epoxy, a polyester, and a phenolic resin will be evaluated. The toroidal winding machine and laminating fixture to be used in this program are described, and plans for specimen fabrication and testing are included. R.T.K.

N64-22342 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
LUBRICANT-COOLANT FLUIDS IN CUTTING METALS AND THE TECHNIQUE OF THEIR APPLICATION (SELECTED PARTS)
M. I. Klushin 9 May 1963 225 p refs Transl. into ENGLISH from the Book "Smazochno-Okhlazhdayushchiye Zhidkosti pri Rezanii Mettalov i Tekhnika Primeneniya" Moscow, Mashgiz, 1961 p 53–97, 112–141, 168–269, 280–290
(FTD-TT-63-105/1+2; AD-414935)

The following topics are discussed: (1) the effect of various lubricants and coolants on the quality of tap-cut threads; (2) the utilization of lubricant-coolant fluids in grinding operations; (3) the cooling and lubrication of cutting zones by a high-pressure fluid stream; (4) lubrications and cooling with dispersed liquids during the reaction of metals; (5) elements of the theory, construction, and exploitation of units for spraying liquids; and (6) experience in the application of sprayed coolants and lubricants in machining metals. I.v.L.

N64-22344 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
GRAPHITE CONTAINING REFRACTORY MATERIALS
N. A. Golushko 22 Jun. 1963 140 p refs Transl. into ENGLISH of the book "Grafitosoderzhashchiye Ogneupory" Moscow, Gos. Nauchno-Tekhn. Izd. Lit. po Chernoy i Tsvetn. Met., 1962 p 1–110
(FTD-TT-63-174/1+2; AD-417133)

The book discusses the production problems of graphite containing refractories having thermal stability. It gives the characteristics of raw materials, their preparation, molding and drying of the products; it gives the methods of heat treatment, the types of spoilage, its causes, and methods for its prevention. The service conditions of refractories and their durability were studied. The designs of intermittent- and kiln-type furnaces are described in detail. Author

N64-22353 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
UTILIZATION OF DIESEL OILS WITH ADDITIVES

G. A. Morozov 7 Nov. 1963 148 p refs Transl. into ENGLISH of the book "Primeneniye Diezel'nykh Masel s Prisadkami" Leningrad, Gos. Nauchno-tekh. Izdat. Neft. i Gorno-topl. Liter. Lenin. Otde., 1962 p 1–113
(FTD-TT-63-605/1+2; AD-424489)

This book gives the properties of diesel oils with additives, and laboratory- and operating-test results for diesels of various types. It has been compiled on the basis of a generalization of advanced experience gained in the development, testing, and application of new types of diesel oils and additives. Author

N64-22354 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DRAWING OF COPPER WIRE IN AN ULTRASONIC FIELD
V. P. Severdenko and V. V. Klubovich 25 Jul. 1963 9 p ref Transl. into ENGLISH from Doklady, AN SSSR (Moscow), v. 7, no. 2, 1963 p 95–98
(FTD-TT-63-675/1+2; AD-417408)

Investigation of drawing wire in an ultrasonic field was carried out on the 250-kg test machine Shoper. An ultrasonic oscillator UZG −1.5 was used to excite high-frequency oscillations. The high-frequency electric oscillations were fed to an ultrasonic head, consisting of magnetostrictor IMS −6 and exponential concentrator. The concentrator material selected was steel 45. The concentrator was soldered to the magnetostrictor with stannic solder. The magnetostrictor concentrator was placed in a metal housing, which was attached to the lower beam of the test machine. Author

N64-22391 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TECHNOLOGY OF MANUFACTURING VOLUMES (SHELLS), HOUSINGS OF FURNACES, AIR HEATERS AND CEMENT FURNACES
S. A. Kurkin 21 Feb. 1963 34 p Transl. into ENGLISH from Tekhnologiya Izgotovleniya Svarnykh Konstruktsiy, Atlas Chertezhey (USSR), 1962 p 67–80
(FTD-TT-62-1615/1+2; AD-400523)

Presented are notes on the quality control and inspection of the welding joints in dimensionless, vertical, cylindrical reservoirs that are used for the storing of petroleum products. The metallurgical study was conducted on the butt and lap joints that connect the petals, the bottom, the lid, and reservoir to the main tank—the gas holder. Because of the high pressures encountered by the gas holders, the welding techniques of various cylindrical tanks are discussed. A.L.B.

N64-22397 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROGRAM CONTROL OF METAL CUTTING MACHINES (SELECTED ARTICLES)
V. I. Kuznetsov 12 Mar. 1963 8 p Transl. into ENGLISH from The Book "Dostizheniya v Oblasti Tekhnicheskogo Proeressa v SSSR" Proftekhizdat, 1961 p 152–157
(FTD-TT-62-1759/1+2; AD-402443)

Program control in metal cutting machines opens possibilities for broad introduction of automation into small-scale and into individual manufacture. Mass-manufacture program control makes the technological process more flexible and allows, with relative ease, the introduction of changes into the manufacturing technology. Program control allows certain actions: (1) automation of conventional universal equipment; (2) controlling simultaneously several machines from one control desk; (3) organizing a central preparation point of program development, which can be easily multiplied and transferred from one plant to another; (4) correcting relatively easily and rapidly machining programs, almost without loss of time and means, and inducing structural changes as well. J.L.D.

N64-22398 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
KINETIC AND GEOMETRIC CHARACTERISTICS OF MARTENSITE CONVERSION IN AN IRON-NICKEL-MANGANIC ALLOY
M. Ye. Blanter and P. V. Novichkov 18 Feb. 1963 14 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal- (USSR), no. 11, 1961 p 12–19
(FTD-TT-62-1760/1+2; AD-400501)

Isothermal martensite conversion was investigated in an iron alloy having 23.02% Ni and 3.35% Mn. A method was developed for determining the effects of temperature and degree of transformation on the rate of nucleation and the dimensions of the martensite crystals formed. The temperature dependence of the rate of nucleation n is characterized by a curve with a maximum, and the absolute value of n drops progressively with a rise in the degree of transformation, becoming equal to zero at the moment transformation ends. The activation energy of nucleation does not depend upon temperature and degree of transformation and equals about 940 cal/g atm. An equation is proposed that expresses the dependence of the rate of nucleation of martensite crystals upon temperature and degree (time) of transformation. It is shown that the thickness, size, and volume of martensite crystals do not depend essentially upon temperature, but are determined exclusively by the degree of transformation. M.P.G.

N64-22443* Lockheed Missiles and Space Co., Sunnyvale, Calif. Nuclear Space Programs
INTERCHANGEABILITY PLAN
21 May 1963 4 p
(Contract NAS8-5600)
(NASA-CR-56360; NSP-63-66) OTS: $1.10 ph

Two sets of control masters will be made to insure control of tooling of the field joint separating the nose fairing, instrument unit, LH_2 tank, interstage, and the S-II stage as well as of the RIFT stage-to-NERVA engine joint of the RIFT-S-II vehicle. P.V.E.

N64-22446* Lockheed Missiles and Space Co., Sunnyvale, Calif.
RIFT QUALITY ASSURANCE PROGRAM PLAN
L. L. Woodward Apr. 1964 73 p refs
(Contracts NAS8-5600; NAS8-9500)
(NASA-CR-56346; NSP-63-2-REV.1) OTS: $7.60 ph

This plan delineates control of quality, inspection, and test functions as well as the responsibilities considered necessary to accomplish the following major objectives: (1) assurance that emphasis is placed on maintenance of quality and reliability by the use of the latest engineering drawings and specifications, of data relating to manufacturing and testing capability, and of feedback from inspection records; (2) assurance that all materials, parts, and assemblies conform to contractual requirements and that the intent of design will be maintained throughout all phases of contract performance; and (3) assurance that quality program requirements are satisfied and that the product is inherently capable of conforming to the performance standards. Author

N64-22460* Lockheed Missiles and Space Co., Sunnyvale, Calif.
VALUE ANALYSIS AND PRODUCIBILITY

21 May 1963 16 p Presented at the RIFT Mfg. Eng. Working Group Meeting
(Contract NAS8-5600)
(NASA-CR-56344; NSP-63-58) OTS: $1.60 ph

Value engineering, value analysis, and producibility are differentiated. The relationship of value analysis and cost minimization to the RIFT Program is explained. Y-ring concepts and the 9-ft test tank were studied, saving a considerable amount. Two more projects were undertaken; the results are pending, and the anticipated saving is also large. The individual analysis techniques are described in detail, and the changes in Y-ring design are shown. D.E.W.

N64-22463* Aerojet-General Corp., Sacramento, Calif.
INVESTIGATION OF SYSTEM COMPONENTS FOR HIGH CHAMBER PRESSURE ENGINES. PART I: PROGRAM RESULTS Final Report, 1 May 1963–31 Mar. 1964
May 1964 377 p refs
(Contract NAS8-5329)
(NASA CR-56308; Rept.-5329-F) OTS: $21.00 ph

This report describes the analyses performed to establish the fundamental design requirements for pressure- and size-affected auxiliary engine components such as valves, lines, bellows joints, and heat exchangers for high-thrust (1.5 to 24×10^6 lb) launch-vehicle engines. Problem areas and required technology associated with the design of these auxiliary components for five LO_2-LH_2 engines and one LO_2-RP-1 engine are shown, with most analysis performed on a 6×10^6lb, LO_2-LH_2 gas-liquid staged-combustion cycle, single-pump, eight-chamber engine. Pump discharge pressures of up to 6,000 psi are considered. The study includes engine steady-state and transient analysis, off-design steady-state analysis, and the requirements of associated systems, such as thrust vector control, thrust control, thrust modulation, propellant utilization, and tank pressurization. Author

N64-22469* Lockheed Missiles and Space Co., Sunnyvale, Calif. Nuclear Space Programs
HANDLING AND TRANSPORTATION
21 May 1963 12 p
(Contract NAS8-5600)
(NASA-CR-56234; NSP-63-65) OTS: $1.60 ph

Packaging and handling concepts are discussed. These concepts are directed to an overall system that starts at the beginning of a logistics cycle and ends with delivery of the vehicle from the manufacturing facility. The application of this technique provides a working system that can be used to obtain distinct economic and control advantages within the manufacturing cycle. The preplanned packaging and handling program would apply to large structural components such as preformed panels. The present concept is to design adjustable reusable containers to be used for transport from a vendor into a unique LMSC storage system at PFT. Design effort for the construction of a prototype container and a single section of a special adjustable storage rack is in progress. I.v.L.

N64-22496* Illinois U., Urbana
ON THE STARTING CHARACTERISTICS OF SUPERSONIC EJECTOR SYSTEMS
A. L. Addy and W. L. Chow Repr. from J. Basic Eng. [1964] 8 p refs Presented at the Fluids Eng. Conf., ASME, Philadelphia, 18–21 May 1964
(Grant NsG-13-59)
(ASME Paper-64-FE-9)

The transient pumping characteristics of supersonic ejector systems are investigated both theoretically and experimentally. The theoretical analysis of this transient problem is based on quasi-steady flow concepts. The steady-state ejector analysis, upon which the present study must be based, considers the basic interaction between the primary and secondary streams, as well as the viscous mixing effects that are the predominant flow mechanism at small secondary flow rates. The results of applying this steady-state analysis to the present problem are presented and shown to be in excellent agreement with experimentally observed ejector starting characteristics. Author

N64-22516 Texas Instruments, Inc., Dallas Semiconductor-Components Div.
PRODUCTION ENGINEERING MEASURES. TRANSISTOR RELIABILITY Quarterly Progress Report, 1 Aug.–31 Oct. 1963
[1963] 11 p
(Contract DA-36-039-SC-86730)
(QPR-6; AD-600283)

Three groups of 2N744 series silicon epitaxial planar transistors were placed on life test. A table is presented of the sample sizes and power dissipation levels. A list of parameters, test conditions, and limits for life-test evaluations are also presented in tabular form. R.T.K.

N64-22551 Aeroprojects, Inc., West Chester, Pa.
DEVELOPMENT OF ULTRASONIC WELDING WITH EMPHASIS ON PRODUCING HERMETIC SEALS Final Summary Report
J. Byron Jones, Nicholas Maropis, John G. Thomas, and William N. Rosenberg Sep. 1963 106 p refs
(Contract DA-36-034-ORD-3254-RD)
(RR-61-99; AD-600597)

Uniformly reproducible ultrasonic ring and continuous-seam welds of hermetic-seal quality were produced in several alloys of different gages and in various geometries. The delineation of problems relating to high power delivery in a torsional system indicates that specifications for a ring-type welding unit with a 5-kw power-handling capacity and capable of welding heavy-gage structural aluminum sheet can result. Continuous-seam welds at speeds in excess of 1 ft/min. were produced in 0.040- and 0.064-in. 2014-T6 aluminum alloy, with and without interleaf, using a 5-kw welding unit. Weld strengths achieved were up to 95% of parent metal strength. Modification can be made to the ultrasonic continuous-seam unit to handle up to 10 kw in continuous operation, producing welds at reasonable rates in 0.080-in. sheet. Theoretical and experimental studies delineated impedance-matching requirements for optimum coupling of the ultrasonic energy to the weldment materials. Author

N64-22562 IIT Research Inst., Chicago, Ill.
NONDESTRUCTIVE METHODS FOR THE EVALUATION OF CERAMIC COATINGS Technical Documentary Report, 1 Apr. 1963–31 Mar. 1964
W. E. Lawrie and M. D. Oestreich Wright-Patterson AFB, Ohio, ASD, May 1964 62 p refs
(Contract AF 33(657)-8938)
(WADD-TR-61-91, Pt. IV; AD-601112)

This report describes the investigation of methods to evaluate the quality of ceramic and intermetallic coatings used to provide increased oxidation resistance for refractory metals. A survey conducted during the course of the program indicated that the parameters of importance were (1) coating thickness, composition, and uniformity; (2) the position, lateral extent, and depth of cracks; and (3) the presence of voids, pinholes, and other discontinuities in the coating. The measurement of coating thickness and of layer thickness in multilayer coatings was approached by beta-backscatter measurements. Nuclear

methods for determining coating uniformity and the presence of cracks or other discontinuities are also being studied. The ultrasonic investigations were directed exclusively at the application of Rayleigh wave methods to coating evaluation.
Author

N64-22576 McDonnell Aircraft Corp., St. Louis, Mo. Structures Labs.
THE EFFECTS OF HOT CHROMIC ACID AS AN EPOXY STRIPPER ON COMMONLY USED AIRCRAFT METALS Limited Test Report
Robert F. Weeks 10 Jun. 1964 9 p
(Contract AF 33(657)-11215)
(A730; AD-441108)

The effects of hot chromic acid (40 oz/gal at 180° to 200° F) on commonly used aircraft metals and as a stripper for the baked epoxy primer are discussed. Twenty-four painted panels were stripped in hot chromic acid; the stripping time was recorded; and the panels were rinsed with tap water, dried, and examined for pitting. Although very little pitting was observed, as much as 24.60% weight loss was recorded during immersion testing of 7178-T6 aluminum alloy, whereas less than 2% weight loss was recorded on the magnesium and steel panels. J.L.D.

N64-22578 McDonnell Aircraft Corp., St. Louis, Mo. Systems Lab.
DEVELOPMENT OF DRILLING, REAMING AND TAPPING TECHNIQUES ON H-11 STEEL HEAT TREATED TO 220–240 KSI Final Report
I. A. D. Marco 10 Jun. 1964 13 p
(Contract AF 33(657)-11215)
(A732; AD-441110)

Machining data for H-11 steel heat-treated to 220 to 240 ksi is very limited, therefore this test program was established to determine efficient procedures for drilling, reaming, and tapping operations accomplished with tools available. Testing was conducted for both machine shop and assembly-type drilling, reaming, and tapping with material available. Satisfactory results were obtained in all test phases using crib-stocked cutting tools.
Author

N64-22580 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
EVALUATION OF DUCTILE FILLER METALS FOR WELDING INCONEL X Final Report, 9 Mar.–25 Sep. 1963
Frank J. Coffey 10 Jun. 1964 26 p
(Contract AF 33(657)-11215)
(A735; AD-441113)

Test welding was performed in which the base alloy, Inconel X, was joined with six different filler alloy compositions. These test weldments provided specimens for weld patch, tensile, stress rupture, and bend tests to provide data concerning the relative ductility of the various welds. Based upon the results of tensile elongation measurements (0.5-in. gage length centered across the weld) the filler wires are listed in order of decreasing ductility as follows: Hastelloy W, Inconel 69, Inconel 82, Hastelloy X, L-605, René 41. The bend test results showed the weld zone produced by all filler alloys was less ductile than the base metal, and the relative ductility of the filler wires, in decreasing order, was as follows: L-605, Hastelloy W, Inconel 69, Hastelloy X, Inconel 82, René 41. All weld defects noted occurred during welding; no crack propagation or new defects were evident after postweld heat treatment.
Author

N64-22582 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
DETERMINATION OF THREAD QUALITY OF ROLLED THREADS ON T.D. NICKEL ALLOY BLANK Limited Test Report
10 Jun. 1964 5 p
(Contract AF 33(657)-11215)
(A737; AD-441115)

A threaded sample was prepared using thread rolling equipment. The sample was photomacrographed to show both the external and internal threaded areas. Thereafter, the specimen was cross sectioned, prepared metallographically, and photomicrographed at 100 magnifications to illustrate the thread quality. Metallographic examination of the threaded areas indicate that the rolled threads appear metallurgically sound and free from any internal defects. The internal threads show excessive flatting of the thread crest.
Author

N64-22588 McDonnell Aircraft Co., St. Louis, Mo. Structures Lab.
EVALUATION OF MMS-184 TZM SHEET CONTAINING ULTRASONICALLY DETECTED DISCONTINUITIES Final Report
10 Jun. 1964 22 p
(Contract AF 33(657)-11215)
(A746; AD-441124)

The ultrasonic trace produced by inspection indicated that some areas of the TZM sheet were discontinuous; tests were conducted to compare the grain structures of the continuous and the discontinuous areas, and to compare the mechanical properties of the two areas. Test results are given. To compare the grain structure of the two areas, metallographic examination of sections taken through the longitudinal, transverse, and short transverse planes of both areas was performed. Hardness, shear, bend and electrochemical polishing and deburring tests were conducted to compare the fabricability and susceptibility to exfoliation of the two areas. The grain structure in the discontinuous areas was slightly coarser than in the continuous areas. The hardness tests indicated that the discontinuous areas were softer, by 10 to 17 DPH numbers, than the continuous areas. The shear specimens all fractured in tension. The data from these specimens were scattered and inconclusive, but no distinct difference between the two areas was displayed. All of the bend test specimens fractured while being straightened after the second bend. No exfoliation was observed until fracture occurred.
Author

N64-22589 McDonnell Aircraft Co., St. Louis, Mo. Structures Lab.
METALLOGRAPHIC EVALUATION OF CHEM-BLANKED TZM MOLYBDENUM ALLOY SHEET Limited Test Report
Billie L. Thrasher 10 Jun. 1964 6 p
(Contract AF 33(657)-11215)
(A747; 441125)

The TZM parts are being tested for exfoliation. In many cases, the edge appears to be exfoliated prior to edge preparation. A careful metallographic study was made to determine the nature of the edge condition. Metallographic examination of the edge in question disclosed no evidence of exfoliation. N.E.A.

N64-22591 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
RESISTANCE WELD EVALUATION OF TANTALUM ALLOY (Ta-30Cb-7.5V)

10 Jun. 1964 8 p
(Contract AF 33(657)-11215)
(A749; AD-441127)

Proper spot-welding procedures were carried out on wrought tantalum alloy and recrystallized test specimens. One weld in recrystallized material and one weld in wrought material were sectioned in the transverse direction and prepared metallographically to determine weld quality. Spot welds produced in the recrystallized material exhibited less penetration and shear strength than the equivalent welds in wrought material. N.E.A.

N64-22595 McDonnell Aircraft Corp., St. Louis, Mo.
INVESTIGATION OF THE EFFECT OF DRY FILM LUBRICANTS ON CORROSION RESISTANCE Final Report
10 Jun. 1964 92 p
(Contract AF 33(657)-11215)
(A753; AD-441131)

The results of this investigation indicate that both Electrofilm 2306 and Everlube 620 lubricants used on alodined 2024 and 7075 aluminum decreased the corrosion resistance of these alloys with this surface treatment by a considerable degree. The corrosion resistance of cadmium-plated 4340 steel was adversely affected by the use of Molykote X-106 lubricant. In all of the other cases tested, the lubricants did not decrease the corrosion resistance of the alloys to any great degree, and there were several instances where the lubricants acted to increase the corrosion resistance of the alloys to which they were applied. Author

N64-22596 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
EFFECT OF CADMIUM PLATE ON DRY FILM LUBRICANT WEAR LIFE Final Report
Billie L. Thrasher 10 Jun. 1964 15 p
(Contract AF 33(657)-11215)
(A754; AD-441132)

This test was conducted to gather data concerning the effects of cadmium plate substrate on the wear life and corrosion resistance of dry-film lubricant coated bearings. Cadmium-plated, as well as unplated, steel test cups were used. The wear life of these cups was determined, using the MacMillan lubricant tester with an 80-rpm rotary motion and a 630-lb line-contact load. The corrosion resistance was investigated by first subjecting both plated and unplated test cups to a 4-hr wear test on the MacMillan tester, then to a 24-hr 20%-salt-spray exposure. This cycle was repeated until the coefficient of kinetic friction reached 0.2 on the wear-test portion of the cycle. The cadmium plate substrate decreased the average wear life of the lubricated surface by approximately 40%. Considerable corrosion was observed on both plated and unplated test cups after the first 24-hr salt-spray exposure. Author

N64-22597 McDonnell Aircraft Corp., St. Louis, Mo.
EFFECTS OF MOLYBDENUM DISULFIDE ON 19-9DL AND 321 STAINLESS STEELS AT 800° F
10 Jun. 1964 13 p
(Contract AF 33(657)-11215)
(A755; AD-441133)

Tests were performed to determine the extent of attack by molybdenum disulfide coated on 19-9DL and type 321 stainless steel when exposed to temperatures up to 800° F and on A286 stainless steel when exposed to temperatures of 700° F and 1,000° F. No evidence of attack by molybdenum disulfide on any of the materials examined was observed metallographically. Author

N64-22598 McDonnell Aircraft Corp., St. Louis, Mo.
INVESTIGATION OF PERMEABILITY TO MOISTURE OF FOUR COMMON PAINT SYSTEMS
10 Jun. 1964 10 p
(Contract AF 33(657)-11215)
(A756; AD-441134)

The purpose of this test was to determine which one of four commonly used aerospace paint systems is most permeable to moisture. The paint systems tested were the following: (1) acrylic nitrocellulose lacquer; (2) cellulose nitrate lacquer; (3) MIL-E-7729 enamel, Type I; and (4) MMS-405 epoxy enamel (DeSoto). Aluminum pannels painted with these systems were immersed in distilled water for periods varying from 24 hours to 3 weeks. The paint adhesion was then tested. The results showed that the DeSoto epoxy system was superior in water resistance to the other three paint systems tested.
Author

N64-22621 Air Force Systems Command, Wright-Patterson FB, Ohio Foreign Technology Div.
CONTEMPORARY STATE OF ROLLING-MILL BUILDING IN THE USSR
A. A. Korolev 25 Sep. 1963 196 p Transl. into ENGLISH from the book "Soucasny Stav Vyroby Valcovacich Zarizeni SSSR" Praha Slovenske Vydavatel'stvo Technickej Literatury, 1961 p 119–243
(FTD-TT-62-1216/1+2+3+4; AD-427296)

Advances and problems in the production of rolling mills in the Soviet Union are discussed, and the following types of mill trains are described: (1) semifinishing mill trains; (2) trains for hot rolling sheets; (3) trains for cold rolling sheets; (4) billet trains; (5) structural mill trains; (6) section, rod, and strip mill trains; (7) tube-rolling trains; and (8) special mill trains. P.V.E.

N64-22693 General Electric Co., Cincinnati, Ohio Flight Propulsion Div.
DEVELOPMENT OF MANUFACTURING TECHNIQUES FOR SHEAR SPINNING OF ROCKET MOTOR CASES Final Technical Engineering Report, Dec. 1961 – Jun. 1963
W. H. Kindell Jul. 1963 366 p refs
(Contract AF-33(657)-7288)
(AMC-TR-63-7-711; ASD-TR-63-7-711; AD-406075)

Discussed is the development of advanced forming techniques for manufacturing a lightweight rocket case from high-strength steel. The object of this program was to demonstrate the feasibility of forming a solid rocket case from a single forging using the shear spinning process. Included are the analysis of the forming techniques used, the subsequent machining operations required, and the heat treatment and hydrotest of two lightweight high-strength cases. The techniques and processes followed are described and analyzed in detail. Results and conclusions are supported by pertinent data, and recommendations for future work are made. Author

N64-22702 Microwave Associates, Inc., Burlington, Mass.
RUGGEDIZED MICROWAVE DUPLEXING TUBES PRODUCTION ENGINEERING MEASURES PROGRAM, VOLUME I Final Engineering Report, 12 Mar. 1962–31 Mar. 1964
Paul Basken [1964] 270 p
(Contract DA-36-039-SC-85987)
(AD-601465)

In this report, the entire program is analyzed in three major sections: (1) the technical discussion of the contract work; (2) complete-process specification; and (3) analysis of the quality-control measures carried out. In the technical discussion, an

effort is made to describe the design work in some detail. In addition, the life-test results are summarized, and an analysis is presented of the manufacturing problems. The process specification is intended for the manufacture of tubes by a competent manufacturer. The quality-control section, in addition to listing all inspection positions, includes the final summarized results, technical analysis, and conclusions drawn of the production of the tubes. N.E.A.

N64-22703 Microwave Associates, Inc., Burlington, Mass.
RUGGEDIZED MICROWAVE DUPLEXING TUBES PRODUCTION ENGINEERING MEASURES PROGRAM, VOLUME II Final Engineering Report, 12 Mar. 1962–31 Mar. 1964
[1964] 300 p
(Contract DA-36-039-SC-85987)
(AD-601466)

The following engineering measures for the production of ruggedized microwave duplexing tubes are summarized: (1) inspection procedures; (2) test procedures; and (3) test requirements. I.v.L.

N64-22704 Microwave Associates, Inc., Burlington, Mass.
RUGGEDIZED MICROWAVE DUPLEXING TUBES PRODUCTION ENGINEERING MEASURES PROGRAM, VOLUME III Final Engineering Report, 12 Mar. 1962–31 Mar. 1964
[1964] 315 p
(Contract DA-36-039-SC-85987)
(AD-601464)

This final engineering report gives the following appendixes of the ruggedized microwave duplexing-tubes-production engineering measures program: (1) data sheets and charts; (2) list of the equipment; (3) manufacturing specifications; (4) engineering life-test results; and (5) production life tests. N.E.A.

N64-22709 General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) REINFORCED METALS Quarterly Report No. 6, 1 Oct.–31 Dec. 1963
Willard H. Sutton Dec. 1963 29 p refs
(Contract DA-36-034-ORD-3768-Z)
(AMRA-CR-01/6; AD-438844)

Sessile drop experiments were conducted on two types of nickel (impurity levels of 16 ppm and 31 ppm) and α-Al_2O_3. Contact angles were measured for both types and were consistently higher by about 12° for the purer specimens. Experiments were also conducted using graphite furnace parts in an attempt to provide a more reducing atmosphere. No changes were noted in the equilibrium contact angles, although a dull, thin surface film formed on all nickel specimens. The interfacial reactions between the Ni-α-Al_2O_3 were examined using an optical microscope. A procedure for preparing specimens for determining the interfacial shear strengths is also discussed. Author

N64-22715 Santa Barbara Research Center, Goleta, Calif.
PRODUCTION ENGINEERING MEASURE: PbSe INFRARED DETECTOR—TYPE IR-200 Quarterly Progress Report, 1 Jan.–1 Apr. 1964
G. H. Cook 27 May 1964 65 p
(Contract DA-36-039-AMC-01466(K))
(QPR-5; AD-600713)

Approval of test facilities was obtained from USAEMSA. Recommended changes to the specifications of SCS-34A were obtained from USAEMSA. The preproduction run was not completed due to schedule delays and processing problems. Several manufacturing and inspection procedures were revised to reflect corrective actions and improvements. Approval was received for the inspection and quality control plan submitted to USAEMA. Contract schedule extension was requested and granted. Author

18 MATERIALS, METALLIC

Includes cermets; mechanical and physical properties of alloys and metals; and metallurgy. *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Nonmetallic; 33 Stresses and Loads; and 34 Structural Design.

N64-21497 Minneapolis-Honeywell Regulator Co., Hopkins, Minn.
THE MECHANICAL AND MICROMECHANICAL PROPERTIES OF BORON Interim Report No. 1, 1 Jan.–29 Feb. 1964
J. A. Sartell and C. H. Li 16 Mar. 1964 17 p refs
(Contract NOw-64-0159F)
(HR-64-255; AD-433754)

Several methods of producing polycrystalline boron specimens were evaluated, and zone sintering, hot pressing, and melting were selected for use in this project. Sawing, polishing, and etching techniques were developed for the preparation of boron for mechanical testing and for microscopic examination. Cast boron was prepared and tested and was found to be extremely sensitive to surface condition. Fracture was found to be partly intergranular and partly transgranular. Author

N64-21498 Aluminum Co. of America, New Kensington, Pa. Chemical Metallurgical Div.
INVESTIGATION OF THE MECHANISM OF STRESS CORROSION OF ALUMINUM ALLOYS First Quarter Report, 6 Dec. 1963–29 Feb. 1964
G. C. English and William King [1964] 23 p
(Contract NOw-64-0170-c)
(Rept.-5-OE-33; AD-434234)

Methods have been developed to utilize the standard 1/8-in.-diam tensile bar and stressing fixture for conductivity studies to establish the cathodic protection criterion for both unstressed and stressed specimens. An anodic polarization technique that shows promise for evaluating the interaction between metallurgical structure and electrolyte has also been developed. There are two important factors in the technique: (1) an anodic pretreatment to develop active, localized attack characteristic of the metallurgical structure; and (2) a rapid scanning rate to evaluate this localized attack before it is stifled by film repair. Author

N64-21507 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
AGE-HARDENING
H. Bohm (Clausthal Coll. of Mining, W. Germany) 8 May 1964 20 p refs Transl. into ENGLISH from Aluminium (Düsseldorf), v. 39, no. 12, 1963 p 753–759
(RSIC-174; AD-440100)

A description of the various decomposition states that may occur in the decomposition of supersaturated solid solutions is presented, and the most important age-hardening theories

are discussed. The change in elastic limit and in hardness occurring upon age hardening is compared, and some possibilities of the further increase of strength from age hardening are touched upon. Author

N64-21556 IIT Research Inst., Chicago, Ill.
HIGH-TEMPERATURE OXIDATION PROTECTIVE COATINGS FOR VANADIUM-BASE ALLOYS Bimonthly Report, 1 Feb.–31 Mar. 1964
1 May 1964 12 p
(Contract NOw-64-0140-c)
(IITRI-B6019-3; AD-600043)

The objective of this program is the development of oxidation protective coatings for vanadium-base alloys for use at 1,800° to 2,500° F. The effect of the pack siliconizing process on the mechanical properties of 0.020-in.-thick sheet of V-60 w/o CB–1 w/o Ti is being studied. Samples are being evaluated before and after various high-temperature exposures. Development of an oxidation resistant slurry or liquid cementation type coating for V-60 w/o Cb–1 w/o Ti is progressing. Five slurry compositions containing tin, silicon, silver, copper, aluminum, and columbium were investigated, and several of these show good coverage, even at corners and edges. Author

N64-21575 Manlabs., Inc., Cambridge, Mass.
THERMOMECHANICAL TREATMENTS APPLIED TO ULTRAHIGH-STRENGTH BAINITES Final Technical Report
D. Kalish and S. A. Kulin Apr. 1964 87 p refs
(Contract (N600(19)59811)
(AD-439231)

The mechanical properties of H11 and AISI 4350 steels were determined for a series of bainites formed from both deformed and undeformed austenites. These bainites were subjected to subsequent straining and tempering treatments. Similar thermomechanical treatments were applied to martensite. In the H11 50%-austenite deformation results in considerable strengthening of the bainite. In the bainitic condition, H11 is strongly affected by refrigeration in liquid nitrogen when tempering temperatures below 1,000° F are used. A large secondary strengthening is observed on tempering between 1,000° and 1,100° F resulting in higher strengths and equivalent ductilities as compared to correspondingly treated martensites. Bainites and martensites in both H11 and 4350 show a large response to strain-tempering treatments. Up to 35% austenite is retained when bainite is formed at 550° F from either deformed or undeformed austenite. A.W.

N64-21582 American Machine and Foundry Co., Alexandria, Va. Materials Dept.
DEVELOPMENT OF MANUFACTURING METHODS FOR DEPOSITION FORMING Interim Progress Report No. 1, 20 Jan.–30 Apr. 1964
M. E. Browning, W. H. Webster, Jr., H. W. Leavenworth, Jr., and F. J. Dunkerley [1964] 43 p refs
(Contract AF-33(615)-1375)
(AD-600315)

Two deposition forming processes, previously developed to produce a quaternary tungsten–cobalt alloy and a nickel dispersion hardened alloy, were selected for further development, process refinement, and scale-up to produce and to test representative aerospace components. Studies conducted to determine the effect of varying the cobalt and tungsten content of the bath, the total metal concentration, and the concentrations of the complexing and the addition agent on the alloy deposit revealed the ammoniacal citrate electroforming bath to be readily controlled from the alloy composition standpoint. Practical levels of stress reducers as well as analytical procedures were established. Studies also conducted on the electrocombination process for producing dispersion-hardened alloys indicate that air agitation plus mechanical agitation techniques help produce higher loadings of the dispersoid in the alloy. Analytical techniques involving a high-speed centrifuge for determining dispersoid content within the alloy were investigated. Author

N64-21740 General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
REACTOR TECHNOLOGY REPORT NO. 24—METALLURGY
K. A. Kesselring May 1964 93 p refs
(Contract W-31-109-ENG-52)
(KAPL-2000-21) OTS: $2.25

Sections of Ni-Cr-Fe Alloy 600 omega seals with various amounts of weld metal drop-through were fabricated into specimens and subjected to cyclic strains corresponding to cyclic radial displacements of an omega seal in service. Comparison of the strain ranges that would be expected with the lives required to produce cracking in smooth omega sections and in omega sections with pronounced drop-through indicated an effective strain concentration factor of 2 1/4 due to drop-through. This effect was relatively independent of the extent of drop-through for both depth and breadth of the drop-through zone. In general, cracking was initiated at a notch associated with the weld metal drop-through. The cracks propagated across the specimen so as to produce the shortest crack path. There was no observable tendency for the crack path to be influenced by the weld heat-affected zone or the weld–base-metal interface. Author

N64-21748 Leicester U. (Gt. Brit.)
ION-ION AND ION-SOLVENT INTERACTIONS Annual Technical Report, Jan.–Dec. 1963
M. C. R. Symons [1963] 15 p refs
(Contract DA-91-591-EUC-2799)
(AD-433045)

After exposure to gamma radiation at 77° K, aqueous alkali metal hydroxide glasses are characterized by an intense absorption band, at about 17,000 cm^{-1}, which is lost on exposure to visible light. Comparison of the electron-resonance spectra before and after bleaching suggests that the blue species is paramagnetic, having a symmetrical absorption band width about 14 gauss and g-factor 2.000. The nature of this species is discussed, and it is postulated that the entity in an electron trapped at a hydroxide vacancy. The effect of added halide ion on the electron-resonance spectra is examined. A second species is discussed in terms of a O^- radical, strongly perturbed by the medium. A.W.

N64-21802 California U., Berkeley
EFFECT OF HIGH THERMAL RADIATION FLUX ON SEVERAL METAL ALLOYS Technical Report, Jun. 15, 1961–Nov. 15, 1963
Thomas H. Hazlett, Robert C. Eberhart, and Mark J. Davis Wright-Patterson AFB, Ohio, Avionics Lab., Mar. 1964 60 p
(Contract AF 33(616)-8447)
(AL-TDR-64-27; AD-434448)

The argon–tungsten arc image furnace has been developed as a facility for testing materials under very high thermal flux densities in either a vacuum or controlled atmospheres. The

furnace is capable of maintaining a flux density at the specimen of 2.9 kw/cm^2 for prolonged periods of time. Details of the facility and performance characteristics are described, together with the associated instrumentation. Commercially pure tungsten, AISI 4130 steel in the as-quenched fully heat treated condition, and 2024-T3 aluminum alloy were subjected to the maximum thermal flux for varying lengths of time and changes in microstructure and hardness observed. The 0.007-in.-thick tungsten recrystallized in less than 1.5 sec under these conditions while 0.030-in.-thick sheet recrystallized in 2.5 sec. Radiation pulses as short as 0.1 sec produced metallurgical changes in 0.032-in.-thick AISI 4130 and a 0.3-sec pulse caused incipient melting. Author

N64-21830 Oak Ridge National Lab., Tenn.
DIFFUSION OF TITANIUM-44 AND VANADIUM-48 IN TITANIUM
James F. Murdock Jun. 1964 76 p refs
(Contract W-7405-ENG-26)
(ORNL-3616)

The diffusion behavior of titanium-44 and vanadium-48 in body-centered cubic titanium was studied over the temperature range 900° to 1,550° C using lathe sectioning and gamma spectrometry to determine the activity-distance profiles. Extensive use was made of the CDC 1604 and the IBM 7090 digital computers in analyzing the experimental data. Three possible explanations of the observed behavior are discussed: (1) The activation energy is a temperature-dependent function for a single mechanism. (2) Diffusion along short-circuit paths predominates at low temperatures. (3) There may be two or more competing volume diffusion mechanisms. The proposed model of Kidson qualitatively explains the data. However, with the data presently available, no single explanation of the observed anomaly can as yet be ruled correct. Author

N64-21912 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
DEVELOPMENT OF A HIGH-STRENGTH STRESS-CORROSION-RESISTANT ALLOY WITH AN AlZnMg BASE, PART II
W. Rosenkranz 8 May 1964 23 p refs Transl. into ENGLISH by JPRS from Aluminium (Düsseldorf), v. 39, no. 12, 1963 p 741–752
(RSIC-177; AD-600688)

The influence of chemical composition on artificial age hardening and stress corrosion of high-strength AlZnMgCu alloys was investigated. In particular, seven different alloys were studied in order to find: (1) the influence of chemical composition on the course of age hardening; (2) the static strength of the alloys in the longitudinal and vertical direction; (3) the stress-corrosion behavior in the vertical direction; and (4) the general stress-corrosion behavior, in weathering tests, of bent T-section samples (i.e., subjected to strong plastic deformation). P.V.E.

N64-21923 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRESSING, FORGING AND STAMPING IN THE U.S.S.R.
A. V. Altykis, D. I. Berezhkovskiy et al 1 Apr. 1963 243 p refs Transl. into ENGLISH of "Lisovani a Kovani v CSSR a SSSR" Prague, SNTL, 1961 p 167–337
(FTD-TT-62-1676/1+2; AD-405786)

A general review of metal pressing, forging, and stamping techniques and facilities in the U.S.S.R. is presented. Among the topics covered are methods of force calculation, forging on die presses, horizontal forging, die forging, forging rollstands, stamping presses, rolled ring blanks, bending and straightening operations, cold stamping, automation, transverse rolling, extrusion on hydraulic presses, die forging light alloys, mass production of railroad wheels, and forging on power hammers and crank presses. M.P.G.

N64-21944 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATING DIFFUSION MOBILITY OF ZIRCONIUM IN ZIRCONIUM-NIOBIUM ALLOYS
G. G. Ryabova and P. L. Gruzin 31 May 1963 9 p refs Transl. into ENGLISH from Met. i Metalloved. Chistykh Metallov, Inzhenerno-Fix. Inst., Tr. (Moscow), no. 3, 1961 p 120–126
(FTD-TT-63-258/1+2; AD-414377)

The obtained experimental data on the measurement of the diffusion coefficient of zirconium in zirconium–niobium alloys, of the activation energy of diffusion, and of the pre-exponential multiplier showed that all these values depend upon the concentration of elements in the alloys. With a rise in the niobium content of zirconium alloys, there is an increased activation energy value for the diffusion of zirconium. Simultaneously, there is observed a reduction in diffusion mobility of zirconium atoms. Niobium alloying of zirconium hampers the occurrence of diffusion processes in zirconium and strengthens the force of the bond between the atoms in the crystalline lattice. This is apparently due to the rise in the heat resistance of zirconium in alloys with niobium. N.E.A.

N64-21980 Atomics International, Canoga Park, Calif.
EQUILIBRIUM DISSOCIATION PRESSURES OF THE DELTA AND EPSILON PHASES IN THE ZIRCONIUM-HYDROGEN SYSTEM
J. W. Raymond 31 May 1964 31 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-9374) OTS: $0.75

Pressure–temperature isochores were obtained for zirconium–hydrogen alloys, spanning the H/Zr* composition range of 1.430 to 1.910. The studies were confined to the temperature limits of 300° to 900° C, and to the pressure limits of 0.01 to 10.0 atm. An expression equating equilibrium dissociation pressure to temperature and composition was determined, as was the heat of solution function over the range of composition studied. Based on the results of the study, a modification to the zirconium–hydrogen binary phase diagram was proposed, involving construction of a single line, extending upward in temperature from the $ZrH_{1.59}$ composition, and denoting onset of the $\delta \rightarrow \epsilon$ transformation, in place of the two-phase ($\delta + \epsilon$) region appearing on recent diagrams. Author

N64-21984 General Motors Corp., Indianapolis, Ind. Allison Div.
EVALUATION OF 18% Ni-CoMo MARAGING STEEL FOR HEAVY AND THIN WALL ROCKET MOTOR CASE APPLICATIONS
G. R. Sippel and G. L. Vonnegut 12 Jul. 1963 62 p refs
(Rept.-3448)

The strength, fracture toughness, and other pertinent characteristics of 18% Ni–CoMo parent material and TIG welds were determined for 0.400-in. plate, ring-rolled forgings, and 24-in.-diam thin wall (0.135 in.) roll-formed cylinders. The adequacy of inherent parent material properties, and suitability of roll forming and welding procedures for production of thin wall rocket motor cases was demonstrated by successful destructive hydrotests of two 24-in.-diam subscale pressure vessels, each of which achieved 328-ksi biaxial ultimate strength—a 12.5% improvement over the uniaxial ultimate strength of 290 ksi. Author

N64-21990 General Electric Co., Cincinnati, Ohio Missile and Space Div.
DYNAMIC SHAFT SEALS IN SPACE Quarterly Report No. 7, Period Ending Jan. 15, 1964
15 Jan. 1964 17 p
(Contract AF 33(657)-8469)
(AD-432064)

Progress is reported in the following areas: (1) Investigation of modifications to the dynamic zero leakage (DZL) seal was continued. (2) The DZL seal developed for the SNAP-8 project was checked out using Dow ET-378 oil. A successful test run of 36 hr with a vacuum of 29.5-mm Hg sealed from atmosphere was successfully performed without any visible leakage. (3) A computer program was adapted for use in the reduction of the test data obtained during water seal testing. The program is presently adapted for use with the rotating housing seal tests. (4) The liquid metal seal test rig manufacturing continued.
Author

N64-22001 Pennsylvania State U., University Park
THE VARIATION OF LATERAL CONTRACTION RATIO OF LOW-CARBON STEEL AT ELEVATED TEMPERATURES
P. S. Theocaris and E. Koroneos (Natl. Tech U., Athens, Greece) [1963] 31 p refs
(Contract DA-19-591-EUC-2727)

Low-strain rate tests on thin flat-bars at elevated temperatures were performed in a series of tensile specimens made of polycrystalline steel to reveal the influence of temperature on the variation of the lateral contraction ratio in the elastic as well as in the plastic domain of straining. The investigation covered two types of low-carbon steel and one type of low-carbon high-yield-strength alloy steel. The differential moiré method was used for the measurement of relative displacements along the two principal directions of the specimens. The influence of temperature on the instability phenomenon due to the nucleation and propagation of Lüder's bands was studied. Conventional and true longitudinal and transverse stress–strain curves of these materials were traced at various increments of temperature from the ambient up to 450° C (850° F). The jump in the lateral contraction ratio curves at the Lüder's instability zone no longer occurred for temperatures higher than 250° C. All experimental curves were continuous beyond this temperature and tended to straighten up with the increase of temperature.
Author

N64-22057 Frankford Arsenal, Philadelphia, Pa. Research and Development Group
INVESTIGATION OF HALL-EFFECT DEVICES FOR FLAW DETECTION IN METALS
Harry Sipler Mar. 1964 19 p
(R-1710; AD-433895)

This is a study of artificial flaws simulating the random slopes and depths encountered in real surface cracks. Improvements were developed in the test instrumentation to allow photographic records to be made via cathode-ray oscilloscope presentations. Determination of vertical flaw depths greater than 30 mils was found to be feasible as in earlier studies. The direction of flaw inclination from the vertical can be determined exactly; the actual angle of inclination can be only roughly determined for all cases. An exact indication of flaw angle was obtained in about 24% of the cases where the flaw specimens were nearly perfect.
Author

N64-22083 Battersea Coll. of Tech. (Gt. Brit.)
USE OF REACTIVE ATMOSPHERES FOR THE TREATMENT OF B. C. C. METALS Quarterly Engineering Progress Reports, 1 Jul. 1963–31 Dec. 1963
I. J. Toth [1963] 20 p
(Contract N62558-3591)
(QPR-4,5; AD-432903)

The activated sintering experiments have been continued, using high-frequency induction heating. Comparative tests have shown that bromine increases the rate of densification in the temperature range 1,200° to 1,800° C, but high densities have not been achieved. Fracture stress, measured by a miniature bend test, showed correlation with density for short sintering treatments; longer treatments gave anomalous results. The main apparatus has been used to study the effects of impregnating testpieces with solutions of metallic halides before sintering. The intention was to release activating halogens slowly within the compacts. High densities (of the order of 18 g/cm^3) were obtained only when nickel was present, so that nickel activation rather than halogen activation occurred. Other halides (except possibly tungsten bromide) were ineffective.
Author

N64-22102 Battelle Memorial Inst., Columbus, Ohio
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING NOVEMBER, 1963
Russell W. Dayton and Ronald F. Dickerson 1 Dec. 1963 73 p
(Contract W-7405-ENG-92)
(BMI-1657) OTS: $1.75

Reports in the following areas are included: (1) reactor materials and components; (2) studies of fuels; (3) general fuel-element development; (4) radioisotope and radiation applications; (5) development of a tracer system for in-place filter evaluation; (6) coated-particle fuel materials; (7) corrosion studies of the fluoride-volatility process; (8) progress on USAEC–AECL program; (9) fission-product deposition studies; (10) gas-cooled reactor program; and (11) joining of regenerative-cell components.
R.T.K.

N64-22106 New York U., N.Y. School of Engineering and Science
DEVELOPMENT OF TOUGH, HIGH STRENGTH ALPHA-BETA TITANIUM-BASE ALLOYS AT 24,000–260,000 psi YIELD STRENGTH LEVEL Quarterly Progress Report No. 5, 26 Jun.–25 Sep. 1963
P. A. Farrar and H. Margolin [1963] 19 p refs
(Contract DA-30-069-ORD-3690)
(WAL-TR-401-303-4; AD-431680)

This program was initiated in order to develop usable titanium alloys with 0.1% yield strength in the range 240,000 to 260,000 psi, as well as alloys with higher ductility in the range of 190,000 to 240,000 psi yield strength. A total of 15 compositions at two interstitial levels were melted as 8-lb ingots and forged to 1/2-in. bar stock. These alloys have been tested and four 80-lb heats have been melted for further evaluation as bar, plate, and sheet. The compositions chosen for further evaluation were those that would give the desired ductility for the strength levels in the range from 190,000 to 240,000 psi 0.1% yield strength. The ductility obtained ranged from 13.1% elong., 29.1% RA, and 11.7 ft-lb (−40° F) at 193,000 psi 0.1% y.s. to 5.1% elong., 10.7% RA, and 3.4 ft-lb (−40° F) at 238,000 psi y.s.
Author

N64-22107 Canada. Dept. of Mines and Tech. Surveys, Ottawa Physical Metallurgy Div.
RESEARCH AND SPECIAL PROJECTS REPORT FOR 1963
S. L. Gertsman 15 Jan. 1964 77 p refs

Research projects concerned with the following are summarized: (1) alloy development; (2) melting and refining; (3) casting; (4) powder metallurgy; (5) welding; (6) surface treatment and corrosion; (7) mechanical properties improvement; (8) testing procedures and standards; (9) physics of melting

and solidification; (10) structures and transformations; and (11) physical properties of metals and alloys. P.V.E.

N64-22111 Oak Ridge National Lab., Tenn.
USE OF MICRORADIOGRAPHY COMBINED WITH METALLOGRAPHY FOR EVALUATION OF COATED PARTICLES
R. W. Mc Clung, E. S. Bomar, and R. J. Gray Jun. 1964 19 p refs
(Contract W-7405-ENG-3577)
(ORNL-3577)

Metallographic techniques, modified to accommodate the spherical particle configuration, have proved quite useful for observing the structure of both the cladding and the core of nuclear fuels coated with pyrolytic carbon. For nondestructive examination, special low-voltage radiographic techniques have been developed. By employing extremely fine-grained photographic emulsions, optical magnification can be used to make very accurate measurements of the core diameter and coating thickness, and, in addition, the core and coating integrity can be evaluated. Author

N64-22137 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
IDENTIFICATION AND INVESTIGATION OF HEAT-RESISTANT ALLOYS ON A Fe-Ni-Cr BASE
M. V. Pridantsev, E. I. Belikova et al 29 Mar. 1963 54 p refs Transl. into ENGLISH from Spetsial'nyye Stali i Splavy. Tsentr. Nauchno-Issled. Inst. Chernoy Met., Inst. Kachestvennykh Staley (Moscow), no. 7, 1962 p 93–138
(FTD-TT-63-12/1+2; AD-401599)

Investigations were conducted to identify inexpensive, heat-resistant alloys that possess adequately high hot strength at temperatures up to 750° C and have satisfactory mechanical and technological properties. It was found that high heat resistance could be obtained in Fe-Ni-Cr alloys by composite alloying. Several dispersion-hardening alloys that harden during heat treatment were identified. R.T.K.

N64-22171 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEMS OF POWDER METALLURGY AND THE STRENGTH OF MATERIALS (SELECTED ARTICLES)
10 Sep. 1962 55 p refs Transl. into ENGLISH from Vopr. Poroshkovoy Met. i Prochnosti Materialov, AN UKSSR, Inst. Metallokeramiki i Spetsial'nykh Splavov (Kiev), no. 7, 1959 p 33–56, 105–119
(FTD-TT-62-506/1; AD-286595)

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1. RESEARCH ON THE MODULUS OF ELASTICITY OF ALLOYS P. I. Mel'nichuk and I. N. Frantsevich p 1–7 refs (See N64-22172 15-18)
2. THE INFLUENCE OF INTERPHASE SURFACE ENERGY ON WETTABILITY Yu. V. Naydich p 8–17 refs (See N64-22173 15-17)
3. ELECTRON-MICROSCOPE INVESTIGATION OF BREAK SURFACES A. N. Pilyankevich p 18–33 refs (See N64-22174 15-18)
4. A STUDY OF THE INFLUENCE OF TECHNOLOGICAL FACTORS ON THE PRESSABILITY OF IRON POWDERS I. M. Fedorchenko and N. A. Filatova p 34–52 refs (See N64-22175 15-18)

N64-22172 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RESEARCH ON THE MODULUS OF ELASTICITY OF ALLOYS
P. I. Mel'nichuk and I. N. Frantsevich *In its* Problems of Powder Metallurgy and the Strength of Materials (Selected Articles) 10 Sep. 1962 p 1–7 refs (See N64-22171 15-18)

An observed increase in the modulus of elasticity and an observed decrease in the root-mean-square displacement for Ni-W alloys when the tungsten content is increased shows that tungsten increases the strength of the interatomic bonds in the crystal lattice of nickel. The data presented show that the hot strength of Ni-W alloys increases as the tungsten content increases in the region of primary solid solutions. The increase in interatomic bond strength in Ni-W alloys is explained by the fact that tungsten and nickel are transition metals with unfilled d-shells. As a result of overlapping of the S- and d-electron orbits, additional shared-electron bonds are formed, resulting in an increase in interatomic bond strength. P.V.E.

N64-22174 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ELECTRON-MICROSCOPE INVESTIGATION OF BREAK SURFACES
A. N. Pilyankevich *In its* Problems of Powder Metallurgy and the Strength of Materials (Selected Articles) 10 Sep. 1962 p 18–33 refs (See N64-22171 15-18)

The fracture surfaces of sintered metallic powder specimens were studied by using a transmission-type electron microscope. In particular, various methods of making replicas of the fracture surfaces that are sufficiently transparent to electrons are discussed. Three general conclusions are reached with regard to the making of replicas: (1) As a rule, only two-stage replicas can be used to study break surfaces in sintered metallic powder specimens. (2) The most convenient form of two-stage replica for the study of fractures is the replica obtained by pressing a softened film against the fracture to be studied. This method is distinguished by the rapidity with which the primary replica is produced and the ease with which it is stripped from the surface of the specimen. (3) The use of secondary replicas produced by spraying on carbon, silicon monoxide, and metals (in particular, titanium) yields the highest quality results. P.V.E.

N64-22175 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A STUDY OF THE INFLUENCE OF TECHNOLOGICAL FACTORS ON THE PRESSABILITY OF IRON POWDERS
I. M. Fedorchenko and N. A. Filatova *In its* Problems of Powder Metallurgy and the Strength of Materials (Selected Articles) 10 Sep. 1962 p 34–52 refs (See N64-22171 15-18)

Discussed is the influence of the following factors on the pressability of iron powder: (1) the methods of fabrication and the screen classification of the powder; (2) the temperature regime of preliminary powder processing; (3) the atmosphere in which the powder is roasted; (4) the condition of the working surfaces of the dies; and (5) the tumbling operations carried out on the powders studied. Weighed samples of 12.5 g of powder were pressed from two sides in a cylindrical mold 12 mm in diameter with pressing pressures from 0.5 to 10 ton/cm^2. In order to determine the density range in which strong briquettes can be produced without marginal crumbling or chipping, prismatic specimens 5 × 7 × 40 mm in size were pressed under various pressures. The quality of the compacts were determined visually and by technological fracture testing.

Author

N64-22185 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STAINLESS SCALE-, ACID-, AND HEAT-RESISTANT STEELS AND ALLOYS

Yu. P. Davydov and G. V. Pokrovskiy 15 May 1963 19 p refs Transl. into ENGLISH from the Book "Listovaya Shtampovka Legirovannykh Staley i Splavov" Moscow, Oborongiz, 1962 p 58–72
(FTD-TT-63-353/1+2+4; AD-409948)

All stainless scale-, acid-, and heat-resistant steels and alloys are divided into two groups, according to properties exhibited in stamping and heat treatment: (1) chrome steels that are strengthened by hardening and lend themselves satisfactorily to stamping in the annealed state; and (2) chrome and chrome–nickel steels and alloys that are not strengthened by hardening and have high plasticity, lending themselves well to stamping in the hardened state. This report includes discussions of methods for improving the sheet stampability of these steels and alloys, with emphasis upon the drawing operation. I.v.L.

N64-22186 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE RELATION BETWEEN THE SOLUBILITY OF CARBON IN FERRITE AND THE TYPE OF CARBIDES FORMED ON TEMPERING
L. S. Livshits 17 May 1963 7 p refs Transl. into ENGLISH from Metalloved. Term. Obrabotka Metal. (USSR), No. 9, 1962 p 20–22
(FTD-TT-63-349/1+2+4; AD-409041)

The effect of alloying on carbon solubility in ferrite was investigated. Experiments were conducted on bimetallic specimens. A metal was alloyed with various elements in various amounts and was fused to unalloyed steel having 0.16% carbon. The dependence of the decarburization thickness in the unalloyed part on the relative content of the alloyed element was determined. It was shown that on alloying with various carbide-forming elements, certain minimum values of the metal-to-carbon (M/C) ratio are necessary for the decarburization process to begin. A comparison of results of X-ray examination and metallographic observation showed that the carbon migrates when the M/C ratio is sufficient for the development of a special carbide, and the carbide of a cementite type disappears. R.T.K.

N64-22187 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OBSERVATION OF DISLOCATION STRUCTURES IN THE ALLOY KhN77TYuR
V. D. Sadovskiy 17 May 1963 8 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 9, Sep. 1962 p 2–5
(FTD-TT-63-322/1+2+4; AD-409088)

Observations of dislocation structures in quenched, aged, and etched samples of the alloy KhN77TYuR by means of elementary metallographic methods are reported. A sharply defined structure was observed in certain grains, characterized by weak etching and excess phase, which precipitated from the solid solution, forming a chain arranged in the form of a complex system of loops whose individual elements sometimes form a rather accurate geometric design. These are considered to be dislocation loops on the slip plane fixed by the aging-phase precipitation and associated with the effect of quenching stresses. Consequently, decomposition of the solid solution during aging is localized at the dislocation lines, whereas the other grains with more perfect lattices are free from precipitations of excess phase. M.P.G.

N64-22251 Los Alamos Scientific Lab., N. Mex.
FEASIBILITY STUDY OF THE CO-EXTRUSION OF REFRACTORY METAL CLAD REACTOR FUEL ELEMENTS
J. M. Dickinson and T. J. Ready 4 May 1964 20 p refs
(Contract W-7405-ENG-36)
(LAMS-3065) OTS: $0.50

High-velocity co-extrusion is a suitable method of fabricating a 45 v/o UO_2-tungsten cermet and simultaneously cladding it with a refractory metal. Several rods were made using coextrusion ratios of from 4 to 9, and good metallurgical bonds were obtained between the cermet core and the refractory metal cladding. Cladding materials used included molybdenum and molybdenum–tungsten alloys. A co-extruded rod clad with a 25% Mo–tungsten alloy was given a 75% reduction in area by warm swaging, and a typical cold-worked structure was produced, while an excellent bond between the cladding material and the cermet core of the rod was maintained. Author

N64-22266 Manlabs., Inc., Cambridge, Mass.
RESEARCH AND DEVELOPMENT ON HIGH-PRESSURE HIGH-TEMPERATURE METALLURGY Technical Documentary Report, Dec. 1962–Dec. 1963
J. S. Harvey, S. A. Kulin, G. Orner, and S. V. Radcliffe Wright-Patterson AFB, Ohio, AF Materials Lab., Apr. 1964 83 p refs
(Contract AF 33(657)-8764)
(ASD-TDR-63-90, Vol. II; AD-600925)

Techniques were developed for preparing, treating, and testing subsize tensile and Charpy impact specimens suitable for use in high-pressure equipment. The mechanical properties of a wide variety of materials including plain carbon steels, aluminum, stainless steel, and beryllium that were pressure-cycled at room temperature were measured and compared to properties obtained on the same materials that had not been pressure-cycled. A study was made of the effects of pressure on the mechanical properties of several steels including 4,320, 4,340, and H-11 austenitized normally and then tempered at pressure and temperatures in the range of 200° to 500° C. Attempts to austenitize test specimens at pressure invariably resulted in severe microcracking, which precluded measurements of tensile and fracture toughness properties. A series of high-purity iron-carbon alloys ranging from 0.12%C to 1.33% C were austenitized and isothermally transformed both at one atmosphere and at 42 kilobars at selected transformation temperatures. The mechanical properties of specimens subjected to these treatments were measured. Author

N64-22284 Ling-Temco-Vought, Inc., Dallas, Tex. LTV Vought Aeronautics
DEVELOPMENT OF A NICKEL BASE ALLOY SHEET FOR HIGH TEMPERATURE APPLICATION. MECHANICAL PROPERTIES OF INCO 713c SHEET
D. P. Duff and P. D. Watson Wright-Patterson AFB, Ohio, Materials Lab., Apr. 1964 34 p refs
(Contract AF 33(657)-11160)
(ASD-TDR-62-869, Pt. II; AD-600872)

The objective of this program was to measure the elevated temperature tensile and stress-rupture properties of Inco 713c sheet fabricated by the basic process under closely controlled test conditions. Tensile tests at 1,900° and 1,700° F and stress-rupture tests at 1,800° and 1,700° F were conducted on both Inco 713c specimens and René 41 control specimens. The results of the tests confirmed that Inco 713c sheet had much higher tensile and stress-rupture strengths than René 41 at the selected test temperatures, but the ductility of the Inco 713c sheet was below normally accepted values for sheet alloys. A limited program was conducted to demonstrate the feasibility of improving the ductility by minor modifications in the rolling and heat treating procedures. Author

N64-22297 Ohio State U. Research Foundation, Columbus
THE KINETICS OF DIFFUSION CONTROLLED WHISKER GROWTH
V. Ruth and J. P. Hirth Mar. 1964 32 p refs
(Contract Nonr-495(26))
(TR-4; AD-439497)

The problem of surface-diffusion-controlled whisker growth is considered in a moving frame of reference. In addition, diffusive exchange with the substrate is considered. The results are compared with experiment and with prior treatments of whisker growth. The possibility of occurrence of some prior mechanisms of whisker growth cessation is excluded. The material parameters that may be determined from whisker growth experiments are considered. Author

N64-22310 Allegheny Ludlum Steel Corp., Brackenridge, Pa. Research Center
EXTRUDING AND DRAWING MOLYBDENUM TO COMPLEX THIN H-SECTION Third Interim Technical Engineering Report, 1 Jan.–30 Apr. 1964
P. A. Santoli Wright-Patterson AFB, Ohio, Res. and Tech. Div., May 1964 69 p refs
(Contract AF 33(657)-11203)
(RTD-TR-8-112; AD-600999)

Three solid round extrusions of TZM were made to study die design and materials. Similar extrusion quality was found at a reduction ratio of 55:1 from 3,200° F billet temperature with the use of flame-sprayed zirconia dies and pressed and sintered solid zirconia nibs. H-shaped extrusions involving 306 stainless steel resulted in failure of support tooling. Nevertheless, the extrusion displayed good surface quality. Two TZM H-shaped extrusions made with the failed support tooling also showed good surface quality but poor dimensional runout due to insufficient die support. Only flame-sprayed segmented dies were used. Author

N64-22334 Wien U. (Austria) Physikalisches Institut
INVESTIGATION OF THE EFFECTS OF ULTRASONICS ON THE DEFORMATION CHARACTERISTICS OF METALS Final Report, 1 Feb. 1963–31 Jan. 1964
[1964] 25 p refs
(Contract N62558-3436)
(AD-600383)

The softening and hardening effect of irradiation was investigated by means of static tensile tests using metal crystals of zinc and aluminum. Softening occurs if irradiation is superimposed on the static strain during deformation. It may become so marked that the samples are deformed virtually without stress. Crystals thus deformed, however, prove to be hardened to a great extent. Hardening can also be observed with samples that were deformed with only superimposed ultrasonics. This implies that softening occurs during superimposed irradiation, whereas a hardening takes place as soon as irradiation ceases (superposition of two processes possible and one of them prevailing). Author

N64-22388 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SINTERED CORUNDUM
N. M. Pavlushkin 18 Apr. 1963 306 p refs Transl. into ENGLISH from the book "Spechennyy Korund" Moscow, Gos. Izd. Lit. Po Stroit. Arkhitekt. i Stroit. Materialam p 1–214
(FTD-TT-69-912/1+2; AD-402580)

The sources of aluminum oxide, the methods of preparation of corundum (alpha modification of aluminum oxide), and the forms of corundum are described. Corundum sintering is covered in detail, including particle size and form, recrystallization-process modifications, and sintering processes. Density, as well as the mechanical, thermal, electrical, and chemical properties of corundum is tabulated. A number of microphotographs are included, as is a long list of references. D.E.W.

N64-22401 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FORGING MOLYBDENUM AND ALLOYS ON ITS BASE
T. V. Vorontsova and N. N. Morgunova 14 Feb. 1963 12 p refs Transl. into ENGLISH from Kuzn.-Shtampov. Proizv. (USSR), no. 8, 1962 p 8–11
(FTD-TT-62-1789/1+2; AD-400504)

Two phases in the forming of cast molybdenum and of its alloys are discussed. The purpose of forming in the first phase of drop forging is to crush the ingot structure and to impart the necessary technological plasticity to the ingot material. The purpose of forming in the second phase is to impart specific dimensions and shapes to the billet as well as to improve the mechanical properties of the metal. I.v.L.

N64-22407 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EFFECT OF RHENIUM ON THE PROPERTIES OF A COBALT-CHROMIUM-NICKEL-ALLOY
Ye. M. Savitskiy, V. A. Sol'ts, and M. A. Tylkina 5 Feb. 1963 10 p refs Transl. into ENGLISH from Metalloved. i Term. Obravotka Metal., no. 6, 1962 p 10–13
FTD-TT-62-1840/1+2+4; AD-299634)

The cobalt–chromium–nickel alloy K40NKhM is used for certain components of electrical meters that require a combination of antimagnetism, extreme hardness, corrosion resistance, and wear resistance. The hardness of the cobalt alloy can be increased by supplementary alloying. Alloying the K40NKhM alloy with rhenium increases its durability characteristics without decreasing its deformability. An alloy containing rhenium remains nonmagnetic and corrosion resistant. J.L.D.

N64-22415 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Advanced Development Program
CORROSION FATIGUE PROPERTIES OF STRUCTURAL MATERIALS Final Report
R. J. Heitzmann Feb. 1964 24 p refs
(ADR-02-09-64.1)

Corrosion fatigue investigations into Superston 40, cast 420 modified corrosion-resistant steel, K-monel, and titanium 6Al-4V have been completed and data are presented. A comparison of corrosion fatigue strength-to-weight ratios shows titanium 6Al-4V to be the most efficient of the materials studied. Following titanium are Inconel 718, coated 5456-H321 aluminum, and coated 4130 steel. Cast 420 modified corrosion-resistant steel is regarded as a poor material for structural service. This alloy exhibited a severe susceptibility to oxygen concentration cell corrosion and is relatively inefficient from a strength-to-weight standpoint. Author

N64-22428 Boeing Co., Seattle, Wash.
X-20 NOSE CAP TZM MOLYBDENUM Final Mechanical Properties Report

R. G. Edwards 19 Nov. 1963 118 p refs Prepared by the Chance Vought Corp. for Boeing Co.
(Contract AF 33(657)-7132)
(Rept.-311.23; AD-434119)

Test results on TZM alloy bar and plate, bare forgings, and coated forgings are presented. Test results included the following: (1) Coatings applied to TZM alloy bar and alloy forgings reduced the room-temperature average strength to 51% and 41%, respectively, of the bare strength. (2) Coatings applied to either TZM alloy bars or forgings reduced the average elongation at room temperature to essentially zero. (3) Recrystallizing bare TZM alloy bar at 2,700° F for 1 hour improved the average elongation by a factor of 2 (16.9% to 36.1%). (4) Recrystallizing coated TZM alloy bar at 2,700° F for 1 hour after coating improved the average room temperature strength 25% over as-coated bar. (5) Recrystallizing coated TZM alloy forging at 3,000° F for 1 hour after coating improved the average room-temperature strength 65% over as-coated forgings. (6) Average strength and elongation of bare TZM alloy bars and forgings were essentially equal. P.V.E.

N64-22431 Boeing Co., Seattle, Wash.
DESIGN REQUIREMENTS FOR COATED REFRACTORY ALLOYS — MODEL X-20, VOLUME I
W. Glen Dreisbach [1963] 319 p
(Contract AF 33(657)-7132)
(D2-81113-1; AD-433991)

Various material compatibilities were verified at elevated temperatures. In general, molybdenum was compatible with more materials at higher temperatures than were columbium alloys. Both atmospheric pressure tests and reentry profile tests were performed. Tungsten contamination of TZM base metal resulted in thin irregular coatings at the site of contamination, which led to premature oxidation failure during reentry profile testing. Investigation of the effects of base metal cleaning techniques prior to disil coating, for TZM and D-36, showed little influence. Studies of manufacturing sequence showed that, for TZM, 0.0006 to 0.001 in. of coating should be applied prior to assembly. Author

N64-22451 Boeing Co., Seattle, Wash.
EMITTANCE IMPROVEMENT COATING DEVELOPMENT FOR REFRACTORY ALLOYS, MODEL X-20
Clarence E. Kerlee [1963] 815 p
(Contract AF 33(657)-7132)
(D2-81110; AD-434033)

Base metals studied were TZM, FS-82, Mo-0.5% Ti, and D-36. Three main approaches were used to provide high emittances for the silicide-coated refractory metals. The approaches were these: (1) treatment prior to disilicide coating; (2) variations in the basic disilicide application procedure; and (3) variations in the processing following the basic silicide coating. The primary test was the reentry simulator, using anticipated X-20 reentry conditions. Evaluation was also carried out in terms of compatibility with the basic system, oxidation resistance, emittance, adhesion, and reproducibility. The most successful systems were the following: (1) TZM–fluidized bed disilicide–titanium carbide-Dow Corning silicone resin DC806A, and (2) the D-36–fluidized bed disilicide–Synar Binder-silicon carbide. D.E.W.

N64-22483 North American Aviation, Inc., Los Angeles, Calif. Design Producibility—Metals Unit
MARAGING STEEL IN ELEVATED TEMPERATURE AIRFRAME DESIGN
J. A. May 19 Jul. 1963 22 p
(TFD-63-552)

A comprehensive test program on 18Ni maraging steel, 300 grade, is in progress. Information presented was obtained from two heats of 3 1/2-in. by 7-in. bar stock. Data include longitudinal and transverse notched and unnotched tensile strength, compression yield strength, shear ultimate strength, bearing ultimate and yield strength for e/D = 1.5 and 2.0, axial loaded fatigue S-N curves for smooth and notched bars, and 650° F creep data. Data on effects of strain rate and on effects of long-time exposure on tensile properties are also included. Limited formability and weld data are presented, and problems associated with these processes are discussed. On the basis of data obtained to date, 18Ni maraging steel appears to be a suitable material for airframe structural applications subject to temperatures up to 650° F. Author

N64-22488 Douglas Aircraft Co., Inc., Santa Monica Calif. Missile and Space Systems Div.
THE PROPERTIES OF WELDED 18Ni-7Co-5Mo PLATE
Z. P. Saperstein and B. V. Whiteson 30 Apr. 1964 48p refs
(SM-45959)

This paper presents the results of an investigation conducted to determine the fabricability of the 18Ni-7Co-5Mo alloy. Studies related to welding techniques, aging response, fracture-toughness metallurgical considerations, and delayed-failure susceptibility are presented for the alloy. N.E.A.

N64-22501 Hanford Atomic Products Operation, Richland, Wash. Metal Fabrication Development
FABRICATION OF ZIRCALOY-2 CLAD THORIUM-URANIUM ALLOY FUEL ELEMENTS
R. S. Kemper, R. N. Johnson, J. E. Minor, R. G. Nelson et al
Mar. 1964 77 p refs
(Contract AT(45-1)-1350)
(HW-79843)

The fabrication procedures used to produce Th–2.5 wt% U–1.0 wt% Zr Zircaloy-2 clad tubular fuel elements are described. These include vacuum consumable arc melting, coextrusion, material evaluation, end-closure brazing, and cleaning procedures. Conditions for irradiating the fuel elements are also given. Author

N64-22522 Horizons Incorporated, Cleveland, Ohio
REINFORCEMENT OF NICKEL CHROMIUM ALLOYS WITH SAPPHIRE WHISKERS
Mark S. Vukasovich 3 Jun. 1964 27 p refs
(Contract Now-64-0125-C)
(IR-2; AD-601040)

Titanium oxide coatings on single-crystal alumina fibers were unsuccessful as a means for facilitating fiber wetting by liquid iron. Titanium and titanium hydride as additives to the composite system were destructive to the alumina fibers, they promoted fiber wetting by liquid metal in some cases. Aluminum–alumina fiber composite ingots were formed using titanium hydride with some fiber destruction, but with good evidence of fiber wetting. Author

N64-22532 Aerojet-General Corp., Azusa, Calif. Structural Materials Div.
INVESTIGATION OF STRESS CORROSION CRACKING OF HIGH STRENGTH STEELS Informal Monthly Reports Apr. 1964
S. Brelant 3 Jun. 1964 6 p
(Contract DA-04-495-ORD-3069)
(LO414-02-7; AD-600899)

Tests results indicate the following: (1) Stress-corrosion susceptibility of 18% maraging steel increases with strength

level; however, even the lowest strength alloy tested (181-ksi yield) failed when tested in a U-bend configuration in ambient water environments. (2) Complete immunity to failure can be obtained with the conventional martensitic steels by employing a sufficiently high tempering temperature. (3) The addition of 3% NaCl to distilled water lessens the susceptibility of the test alloys to stress corrosion. This trend was most noticeable with the D6AC material. (4) Environmental temperature has a great effect on the failure time of maraging steel with the susceptibility doubling for every 18° F increase in temperature. The conventional high-strength steels were found to be effected little by temperature. (5) Stress-corrosion cracking of maraging steel can be stopped by the application of the proper amount of cathodic current. I.V.L.

N64-22560 Aerospace Corp., El Segundo, Calif.
THE STABILITY OF SELECTED OXIDES, NITRIDES AND BORIDES IN MOLYBDENUM TO 4000° F
J. E. White 20 May 1964 30 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-88; TDR-269(4240-10)-12; AD-441239)

Presented is an evaluation of the compatibility between molybdenum and several refractory compounds as dispersed phases in the 3,000° to 4,000° F temperature range. Compounds included in the study are BN, ZrN, HfN, LaB_6, ZrO_2, and ThO_2. Hot-pressed alloys, consisting of nominally 2.5 vol percent of the refractory phase in a molybdenum matrix, were vacuum annealed to evaluate elevated temperature stability. Evaluation was based on changes in grain size, dispersed phase morphology, hardness and gross macroscopic deterioration. The materials HfN, ZrO_2, and ThO_2 showed potential for dispersion strengthening and were recommended for further development. Author

N64-22568 General Dynamics/Fort Worth, Tex.
AN EVALUATION OF HIGH STRENGTH STEEL FORGINGS
R. L. Jones and F. C. Nordquist Wright-Patterson AFB, Ohio, Res. and Technol. Div., May 1964 156 p refs
(Contract AF 33(600)-41891)
(RTD-TDR-63-4050; AD-601446)

This report presents the results of an investigation of the mechanical properties of high strength steel aircraft forgings. Republic Steel Corporation's 9Ni-4Co and 18 NiCoMo(300) were examined in detail for smooth and notched tensile and fatigue strength, stress corrosion resistance, and fracture toughness properties. In general, the 18 NiCoMo(300) steel was capable of attaining the highest tensile strength, particularly yield strength. However, this higher strength did not manifest itself under fatigue loading conditions. As a result, the 9Ni-4Co steel had higher notched and smooth axial fatigue strength. From a stress corrosion standpoint the 9Ni-4Co steel was superior to 18 NiCoMo where no stress raiser was present. Author

N64-22574 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
DETERMINATION OF THE EFFECT OF GAUGE LENGTH OF CAST ALUMINUM TEST SPECIMENS ON MEASURED PERCENT ELONGATION Final Report
Russell W. Bill 10 Jun. 1964 15 p
(Contract AF 33(657)-11215)
(A728; AD-441107)

The acceptance of heat-treated aluminum alloy castings frequently depends upon arbitrarily specified minimum elongation values to be obtained from test specimens cast from the same heat of material. Two types of specimens, R-1 and R-3, were prepared from each of six heats of aluminum casting alloy 356-T6 and tested to determine whether a relationship existed between elongation, specimen type, and gage length. Within the accuracy limits of elongation measurement, the values obtained during these tests were closely similar regardless of specimen type or gage length. Independent studies indicate that when the ratio of the length to the diameter of the reduced section is approximately 4.0, similar elongation values can be obtained from specimens of various sizes or types. Based upon the results of these tests, the specified minimum elongation values could be similar for either R-1 or R-3-type specimens. Author

N64-22575 McDonnell Aircraft Corp., St. Louis, Mo. Systems Lab.
EVALUATION OF BRAZED HONEYCOMB SANDWICH WITH 6061 FACE SHEETS AND 3003 CORE
James Krieg 10 Jun. 1964 9 p
(Contract AF 33(657)-11215)
(A729; AD-441156)

Specimens were sectioned from the honeycomb panel and prepared for metallurgical examination. Photomacrographs and photomicrographs were taken of the brazed joints. Each of the core-to-face skin joints examined showed a brazed metallurgical joint, as well as a strong tendency of the braze alloy to form fillets. Although most of the joints exhibited a sound microstructure, approximately 25% of the joints examined contained large pores. R.T.K.

N64-22577 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
COMPARISON OF HEAT AND CORROSION RESISTANCE OF DOW 17 AND HAE COATINGS ON HK31-H24 MAGNESIUM ALLOY Final Report
Harold V. Willey 10 Jun. 1964 30 p
(Contract AF 33(657)-11215)
(A731; AD-441109)

Sixty-nine panels of HK31A-H24 magnesium alloy, each panel measuring 0.125 × 4 × 6 in., were prepared and exposed to salt spray, utilizing a 20% salt solution, for a period of 500 hr. The coatings tested were HAE type I, triple-humidity sealed, and Dow 17 types I through IV. Panels covered with each of the five types of coatings were tested simultaneously in the untreated condition, after baking for 5 hr at 700° F, and after being painted (with Pratt and Lambert No. 7897 paint) and baked for 5 hr at 700° F. Uncoated HK31A-H24 magnesium alloy panel surfaces were also exposed to the 500 hr salt-spray test for comparison with the protective ability of the various coatings. The painted panels were tape tested after baking. HAE coating type I, and Dow 17 coating type IV produced poor adhesion of the paint to the substrate. All other coatings permitted satisfactory adhesion of the paint to the substrate. Initial corrosion of all coated panels occurred after 75 to 95 hr of salt-spray exposure. Serious corrosion occurred after 400 to 500 hr of salt-spray exposure, except in the cases of baked and unbaked HAE coating type I, and unbaked Dow 17 coatings types II and III. Author

N64-22579 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
STATIC FATIGUE STRENGTH OF DIFFUSED NICKEL CADMIUM PLATED VASCOMAX 250 AND VASCOMAX 300 Final Report
Russell W. Bill 10 Jun. 1964 18 p
(Contract AF 33(657)-11215)
(A733; AD-441111)

This test was conducted to determine the effects of electroplating on the static fatigue properties of Vascomax 250 and Vascomax 300. Classed as 18% nickel steels, these are high-strength iron-base alloys. The coating evaluated was

diffused nickel–cadmium plating. Testing was performed both before and after an elevated temperature embrittlement relief. The average Fty of the Vascomax 250 of 259 ksi was above the claimed yield of the material. The Vascomax 300 with an average Fty of 271.6 ksi fell below the claimed yield of 300 ksi. There was no evidence of embrittlement in either the baked or nonbaked specimens. Author

N64-22581 McDonnell Aircraft Corp., St. Louis, Mo.
EVALUATION OF INCONEL 718 HONEYCOMB CORE FOR USE IN BRAZED HONEYCOMB STRUCTURE Final Report
D. W. Johnson 10 Jun. 1964 18 p
(Contract AF 33(657)-11215)
(A736; AD-441114)

Honeycomb core fabricated from Inconel 718 ribbon offers a possible solution to the design of lightweight, high-strength structures, such as control surfaces. A series of tests were conducted to determine the physical and mechanical properties for the development of material specifications and process control. A dimensional check, density determination, and physical examination were conducted on the core material before test specimens were taken for node weld shear tests and flatwise compression tests. Test results indicated the core material to be a satisfactory structural material for parts designed for sustained elevated temperature operation. D.S.G.

N64-22583 McDonnell Aircraft Corp., St. Louis, Mo.
STRENGTH COMPARISON OF COATED BERYLLIUM SPECIMENS Final Report
D. W. Johnson 10 Jun. 1964 22 p
(Contract AF 33(657)-11215)
(A738; AD-441116)

The 45-32243 cylindrical section shingles fabricated from S-200A sintered beryllium are coated on one side with a low emissivity gold coating. An analysis of the gold–beryllium phase diagram indicates that it is possible for beryllium and gold to form an intermetallic compound, and conceivably this action could reduce the mechanical properties of the shingles. This test was conducted to compare the mechanical properties of coated vs uncoated beryllium specimens. Mechanical property tests included notched and unnotched tensile and modulus of rupture tests at room temperature, 1,000°, and 1,500° F. In addition, axial fatigue tests were conducted at room temperature, 1,000°, and 1,200° F. Tensile strengths decreased from 42,000 to 45,000 psi at room temperature to 2,100 to 3,200 psi at 1,500° F. Modulus of rupture (bending ultimate) decreased from 72,000 to 89,000 psi to 6,200 to 7,700 psi at 1,500° F. The fatigue life tensile strength and modulus of rupture of coated and uncoated specimens appear equivalent. There was no significant difference observed between the coated and uncoated beryllium specimens tested. Author

N64-22584 McDonnell Aircraft Corp., St. Louis, Mo.
EFFECT OF THERMAL CYCLES ON THE MECHANICAL PROPERTIES OF COLUMBIUM (D-14) ALLOY Final Report
10 Jun. 1964 28 p
(Contract AF 33(657)-11215)
(A739; AD-441117)

Columbium alloy D-14, coated with LB-2, suffers a loss in mechanical properties when subjected to subsequent coating repair thermal cycles. To determine the effect of the original coating cycle temperature, as well as that of subsequent coating repair cycles, upon the mechanical properties of the substrate, a number of specimens were subjected to mechanical property testing. Coating LB-2 at 1,900° F resulted in an increase in tensile yield and ultimate tensile stresses, and a repair cycle at 1,700° F induced a further slight improvement in these properties when testing 0.019-in.-thick material. Additional coating repair thermal cycles, to a total of four, caused little noticeable change in mechanical properties. A coating cycle performed at 1,700° F resulted in higher mechanical properties; subsequent repair cycles at 1,700° F resulted in a lowering of the 600° F mechanical properties, although there was little change in the room-temperature properties. Author

N64-22585 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
METALLOGRAPHIC EXAMINATION OF D—14 COLUMBIUM ALLOY CORE JOINTS Limited Test Report
10 Jun. 1964 5 p
(Contract AF 33(657)-11215)
(A741; AD-441119)

A sample of D-14 core was submitted for metallographic analysis. Metallographic examination of the columbium core joint indicates that the joint contains braze characteristics. However, continuity of the braze across the interface appears questionable since the transverse section indicates the majority of penetration occurred on one side of the interface, while the longitudinal section shows evidence of partial bonding in areas along the interface. N.E.A.

N64-22586 McDonnell Aircraft Corp., St. Louis, Mo.
FABRICATION CHARACTERISTICS OF COLUMBIUM BASE ALLOYS B-33 (Cb-4V) AND SCb-291 (Cb-10Ta-10W) Progress Report No. 2
J. P. O'Connor 10 Jun. 1964 147 p
(Contract AF 33(657)-11215)
(A743; AD-441121)

Test results are presented concerning the formability, weldability, and coatability of 0.010-in.-thick and 0.016-in.-thick B-33 (Cb-4V) columbium base alloy. A beaded shingle was successfully drop hammer formed. Uniform elongation testing yielded the following data: yield stress, 58.2 ksi; flow stress, 61.3 ksi; ultimate stress, 80.1 ksi; total elongation in 2.7 in., 17.9%; uniform elongation, 14.7%; and plastic strain ratio, 1.77. Base metal specimens were readily bent around a 0.005-in. radius mandrel. Welded specimens showed good ductility when bent around a 2t radius mandrel. Manual tungsten inert gas (TIG) fusion butt-welded specimens maintained base metal strength and ductility in tension. Resistance spot welded specimens and TIG arc spot welded specimens exceeded the requirements of PS 22142 and PS 22161, respectively. LB-2 coated specimens approximated the performance of Tapco coated specimens, which were successfully oxidation tested for relatively long exposures. The test results indicate that B-33 is easily formed, efficiently welded, and responsive to coating. Author

N64-22587 McDonnell Aircraft Corp., St. Louis, Mo. Systems Lab.
EFFECT OF DIFFUSED CHROMIUM PLATE ON 1/2 PERCENT ZIRCONIUM-MOLYBDENUM ALLOY Limited Test Report
Gorman Morris 10 Jun. 1964 6 p
(Contract AF 33(657)-11215)
(A745; AD-441123)

To determine the effect of diffused chromium plating on the mechanical properties of 1/2% zirconium–molybdenum alloy, six subsize tensile specimens were tested in tension. Three of the specimens were smooth, and three were notched by drilling a hole in the center of the specimen. Tensile tests

disclosed no significant difference between the mechanical properties of the smooth and the notched tensile specimens. N.E.A.

N64-22590 McDonnell Aircraft Corp., St. Louis, Mo. Structures Lab.
TENSILE PROPERTIES OF SILICIDE COATED TZM MOLYBDENUM ALLOY SHEET AT ROOM AND ELEVATED TEMPERATURES Final Report
10 Jun. 1964 15 p
(Contract AF 33(657)-11215)
(A748; AD-441126)

A need for preliminary tensile data concerning W-3 silicide-coated TZM molybdenum has arisen as a basis for vendor qualification tests. The ultimate tensile stress, tensile yield stress, and elongation of coated specimens, coated specimens oxidation check tested, and uncoated specimens were determined at room temperature. The same properties of coated specimens were determined at various elevated temperatures. Tests conducted at room temperature revealed that Fty and Ftu of coated specimens were from 3% to 10% less than uncoated specimens. Coated specimens exhibited similar properties that were approximately 60% of their room temperature tensile properties at 1,800° F, but only about 25% at 2,500° F, and less than 10% at 3,000° F. As the test temperature was increased, the elongation decreased from 7% at room temperature to a value too small to be measured accurately at 2,500° F and 3,000° F. Author

N64-22634 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STRUCTURAL STATE AND HEAT RESISTANCE OF ALLOYS
I. L. Mirkin and V. Z. Tseytlin 4 Mar. 1963 17 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 2, 1961 p 2–11
(FTD-TT-62-1756/1+2; AD-400522)

The structural state and the heat resistance of nickel-chrome alloys and austenitic steel were investigated. Results indicate the following: (1) Maximum heat resistance can be attained only in heterogeneous alloys and steels or in supersaturated solid solutions where excessive phases are separated at high temperature. (2) Alloys with sluggish diffusion processes and volumetric reactions between the phase components (which cause a small rate of structural and phase conversions) retain heat resistance for a much longer period of time; creep and relaxation take place at a lower rate. (3) The initial structural state of the alloy is determined by the composition and state of the mother (starting) solid solution and separation phases and also by the mutual disposition and interaction of these phases. (4) The presence of several elements is more effective than the introduction of an equal (in atomic concentration) amount of one element. I.v.L.

N64-22683 Chemical and Metallurgical Research, Inc., Chattanooga, Tenn.
STUDY OF LOW MELT BRAZING ALLOYS Final Report, 27 Jun.–30 Oct. 1963
Julian Glasser and William E. Few Wright-Patterson AFB, Ohio, Advanced Fabrication Tech. Branch, 1 Feb. 1964 52 p refs Prepared for Ohio State U. Res. Foundation
(Contract AF 33(657)-8741)
(ML-TDR-64-25; AD-434108)

This study brings forth the possibilities of many material compositions that offer potential as low melt braze alloys for joining thin stainless steel strips at temperatures below 1,000° F, and with shear lap joint strengths of at least 10,000 psi up to 200° F. Low melt brazing alloys might find application in such processes involving strip overlap and continuous braze where post heat treating and inert atmospheres may not be practical. Author

19 MATERIALS, NONMETALLIC

Includes mechanical and physical properties of nonmetals (e.g., plastics). *For related information see*: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N64-21509 Air Force Systems Command, Wright-Patterson AFB, Ohio AF Materials Lab.
HIGH TEMPERATURE FERROELECTRIC MATERIALS
R. W. Ohlwiler Mar. 1964 24 p refs
(ML-TDR-64-24; AD-437307)

This report reviews published data on high-temperature ferroelectric materials. Applicable terms are defined, and general characteristics of this type of material are given. High-temperature ferroelectric materials studied were: lead metaniobate, lithium tantalate, potassium niobate, lead titanate, sodium tantalate, and lead metatantalate. Other ferroelectric materials with less supporting data are discussed also. Author

N64-21534 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Inst. für Flugzeugbau
AN INVESTIGATION OF THE TIME-PHASE RELATIONSHIP OF METAL ADHESIVE BONDINGS [UNTERSUCHUNG DES ZEITSTANDVERHALTENS VON METALLKLEBVERBINDUNGEN]
H. Meckelburg and W. Althof 12 Oct. 1963 53 p refs in GERMAN
(DFL-229) DFL: DM 14

The time-phase relationship of single-lip overlapping metal adhesive bondings (phenol resin and epoxy resin) was investigated at room temperature. Creep deformation up to rupture of the bonding was measured. Results were evaluated according to a special statistical method of W. Weibull. This investigation led to a shorter test method for determining the bondings. The method concerns the deduction of the fatigue strength for long lifetime by measuring the creep deformation under elevated time-phase loads for a correspondingly shorter lifetime. The estimated rupture-time point, under weaker loads, is determined graphically by extrapolating the log-log plotted straight-line creep processes. I.v.L.

N64-21593 Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
MOLECULAR CHANGES IN POLYAMIDE AND ELASTOMERIC POLYMERS DUE TO NUCLEAR, ULTRAVIOLET AND THERMAL RADIATION Final Report, 5 May 1960–31 Dec. 1963
G. Hargreaves 15 Dec. 1963 39 p refs.
(AD-434216)

Several types of nylon fibers were exposed to gamma, ultraviolet and thermal radiation and different atmospheric conditions. The unexposed and exposed specimens were examined by the following techniques for the purpose of obtaining information concerning the physical and chemical changes in the structure of the polymer: viscosity of solutions, melting point, infrared spectra, ultraviolet absorption, and microscopy. The tensile strength was measured in some instances. Results show that no one method gives a complete picture, but the combined results from many methods give some insight into the molecular changes taking place as a

result of irradiation. Some of these changes are; (1) the molecules break at the C–N bonds creating smaller molecules and appreciable changes in the physical state, and (2) the degree of crystallinity changes. The ultraviolet resistance of some nylons is improved by small doses of gamma irradiation. Author

N64-21683 Naval Research Lab., Washington, D.C. Mechanics Div.

THERMAL SHOCK STUDIES OF CERAMIC MATERIALS

K. Mc Kinney and H. L. Smith 30 Dec. 1963 14 p refs (NRL-6029; AD-431798) OTS: $0.50

A test method was developed and used for comparing the thermal shock characteristics of several ceramic materials. The method is simple and inexpensive making use of a circular disk of ceramic material containing a central hole. Thermal stresses are imposed by heating the inside of the central hole with a methane-oxygen torch. Thermocouples, placed at different distances from the central hole, give information on temperature versus time for various torch flame temperatures. Additional information may be obtained on crack velocities in each material by painting concentric silver strips on the disk surfaces. By connecting each strip to an oscilloscope, the path of the fracture may be followed as the crack progresses across the plate. Comparative thermal shock data were obtained for two types of alumina, a crystalline glass, and a borosilicate glass. Information obtained through these studies will be used in an attempt to correlate fracture toughness with various thermal shock parameters. Author

N64-21786 General Electric Co., Philadelphia, Pa. Space Sciences Lab.

EFFECT OF GLASS FORM ON STRENGTH Technical Information Series Report

B. Walter Rosen Feb. 1964 28 p Presented at the Tripartite Tech. Cooperation Program Conf. on Factors Affecting Strength and Stiffness of Glass Fibers, Arlington, Va., Oct. 15–16, 1963 (Contract NOw-63-0674-c)

(R64SD18; AD-433806)

The effect of glass fiber on the strength of reinforced plastic composites has been studied analytically. The results indicate that hollow glass fiber composites produce lower weight structures than equivalent solid glass fiber composites for applications where compressive strength or stability is the governing design criterion. Compressive and tensile applications have been considered, and the results of an approximate solution for the internal stresses in the vicinity of a discontinuous fiber are presented. Author

N64-21787 Georgia Inst. of Tech., Atlanta Engineering Experiment Station

CERAMIC SYSTEMS FOR MISSILE STRUCTURAL APPLICATIONS Quarterly Report No. 5, 1 Nov. 1963–31 Jan. 1964

N. E. Poulos, J. N. Harris, and J. D. Walton, Jr. 31 Jan. 1964 27 p

(Contract NOw-63-0143-d)

(QR-5; AD-431544)

The effects of type of wood fiber, ratio of wood fiber to refractory particulate material, and ratio of coarse to fine particles of particulate material in the compact were studied using two firing schedules and two types of suspending and binding systems. The suspending and binding systems were: an organic system (corn starch) whose final products would burn out on firing in an oxidizing atmosphere; and an inorganic system (aluminum chlorhydroxide) whose final products after firing would be the same as the refractory particulate material in the compact. The organic binder proved to be more effective than the inorganic binder. It provided more rapid drain times in felting, higher green densities, and better sintering at 2,500° F. Author

N64-21922 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

A STUDY OF THE WEAR-RESISTANCE OF ENAMEL COSTINGS WITH REFERENCE TO THE LIFE OF MACHINE PARTS

V. S. Lomakin and V. I. Savchenko 14 Mar. 1963 38 p refs Transl. into ENGLISH from the Book "Treniye i Iznos v Maschinakh" Moscow, Izd. Akad. Nauk SSSR, 1960 p 63–92 (FTD-TT-62-1659/1+2+4; AD-400525)

Results of this study indicate the following: (1) The resistance of enamel coatings to abrasive wear may be regarded as the result of two properties of the coating—the resistance to wear of the surface layer and the resistance to rupture of the structure of the underlying enamel. (2) The wear of enamel coatings increases with increasing grain size of the abrasive. (3) The degree of moisture of the abrasive, as is true for moisture in general, has no appreciable effect on the wear resistance of enamel coatings. (4) Nonacid-resistant enamels, when subjected to wear in an abrasive medium containing a sulfuric acid solution, possess considerably greater wear resistance than steels and a chrome coating. (5) Enameling of parts, in addition to increasing their useful life, leads, in a number of cases, to an improvement in the operational characteristics of the machine. (6) Enameling, in the majority of cases, does not require any change in design in machine parts; at the most, a few insignificant structural changes are sometimes necessary. (Parts intended for enameling are made of low-carbon steels and gray iron.) I.v.L.

N64-21926 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THE EFFECT OF COMPOSITION, HEAT, AND ELECTROLYTIC TREATMENT ON THE DIELECTRIC PROPERTIES OF STEATITE CERAMICS

K. A. Vodop'yanov and B. G. Karov 25 Jan. 1963 13 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zavedeniy, Fiz. (Tomsk), no. 3, 1962 p 55–61

(FTD-TT-62-1800/1+2+4; AD-298214)

To reveal the effect of thermal and electrolytic treatment of steatite ceramics on their electrophysical properties, measurements were made of their permittivity and loss angle. The following conclusions were made: (1) At room temperature and high frequency, ceramic bodies have good dielectric properties. At elevated temperatures in the low-frequency range, these properties drop noticeably because of high dielectric losses of conductivity. (2) Electrolytic treatment at low field strengths and low temperatures does not have a noticeable effect, owing to the low mobility of the weakly attached ions. (3) The structure of the ceramic bodies is resistant to heat treatment. Silvering does not cause a noticeable deterioration of the dielectric properties if the silvering process is short. With prolonged firing, the binding energy of the structural elements of the ceramics is reduced owing to diffused silver ions, and the dielectric properties deteriorate. E.K.R.

N64-21935 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATION OF THE ELASTIC PROPERTIES OF ROCKS UNDER HIGH ISOSTATIC PRESSURES

Wei-Chin Fang 23 Mar. 1964 41 p refs Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. II, no. 1, 1962 p 28–46

(FTD-TT-63-725/1+2+3+4; AD-439579)

Described is the determination of elastic parameters for rock specimens under high isostatic pressures by various static and dynamic methods. Measurements were made for diabase, basalt, granite, and limestone, which are rocks widely distributed in the earth's crust. The results show that under the pressure ranging from 1 to 1,000 kg/cm^2 all elastic parameters of the above-mentioned rocks increase continuously with the increasing pressure. The difference between the static and dynamic elasticity parameters is discussed in terms of the theory of elasticity; the results of determination by various methods and their variation with the pressure are given for comparison. The applicability of the static or dynamic elasticity parameters depends on the nature of investigation in a particular case.

Author

N64-21947 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

BLANKET FOR EXTINGUISHING FIRE AND FOR PROTECTING AGAINST THERMAL AND RADIOACTIVE RADIATIONS

Wieslaw Giryn and Kazimierz Grzeszczyk 10 May 1963 5 p Transl. into ENGLISH from Polish Patent No. 40188, 15 Oct. 1957 p 276

(FTD-TT-63-369/1; AD-405708)

A blanket for extinguishing fires and for protecting against thermal and radioactive radiations is described. The blanket is of single or double fabric made from a glass yarn (fibers), without the addition of other fibers. The blanket is saturated with any one substance acting as a fire extinguisher, e.g., ammonium carbonate, ammonium chloride, etc. In addition, the glass fabric of the blanket is saturated with a substance, such as lead sulfide, which slows down or stops the penetration of free thermal radiation neutrons, and of alpha and beta radiations.

I.v.L.

N64-21955 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

METHOD OF INVESTIGATING GLASS-CRYSTAL STRUCTURE

M. A. Bezborodov and A. M. Kripskiy 10 Feb. 1964 22 p Transl. into ENGLISH from Nauchn. Tr. Belorussk. Politekhn. Inst. (USSR), no. 82, 1960 p 3–15

(FTD-TT-63-796/1+2+4; AD-435498)

The importance of a knowledge of the kinetics of crystal order and structure in glass is stressed, and a sequence of methods for investigating the structural changes in glass is proposed. The methods included in this sequence are discussed individually, and their usefulness at different stages of glass crystallization is indicated.

M.P.G.

N64-21991 Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.

IMPROVED RESIN SYSTEMS FOR POLARIS FILAMENT WOUND CASES Progress Report, May 1–Dec. 31, 1963

C. R. Schwallie and J. D. Gibson [1964] 21 p refs

The objective of this program was to provide an orderly definition of epoxy resin parameters as they pertain to internally pressurized filament-wound structures. Testing has been completed on the following three resins: bis(2,3-epoxycyclopentyl) ether, diglycidyl ether of Bisphenol PA and the control, diglycidyl ether of Bisphenol A. In addition, tests were made of heat distortion, permanent set at 75% of ultimate load, and torsion. Subscale fiber glass chambers fabricated with the above resins were wound and tested. Fiber glass rings made of the same resins were wound and tested for interlaminar shear; no major differences were found.

R.T.K.

N64-22021* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF WEIGHT, DENSITY, AND HEAT LOAD ON THERMAL-SHIELDING PERFORMANCE OF PHENOLIC NYLON

Andrew J. Chapman Washington, NASA, Jun. 1964 26 p refs

(NASA-TN-D-2196)

Phenolic-nylon heat-shield specimens of identical configuration were tested at varying unit weight, density, and total heat load in an electric-arc-heated airstream. The stream stagnation enthalpy was approximately 3,000 Btu/lb, and the heating rate to the specimens was between 90 and 120 Btu/ft^2-sec. The results of these tests indicate that low-density phenolic nylon experienced a lower rate of mass loss and temperature penetration on a unit-weight basis than did high-density phenolic nylon. The mass loss or pyrolysis rate approached a quasi-steady value with increasing heat load. A thermal-shielding efficiency, defined as the quotient of the total heat load and the unit weight of material, was increased primarily by reducing the density of the material. Efficiency was also increased by allowing the maximum back-surface-temperature rise to increase.

Author

N64-22022* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

AN EVALUATION OF ETCHANTS AND TECHNIQUES USED TO PRODUCE DISLOCATION ETCH PITS ON SODIUM CHLORIDE

Carl A. Stearns Washington, NASA, Jun. 1964 12 p refs

(NASA-TN-D-2325) OTS: $0.50

A comparison of the six most commonly used etchants for sodium chloride has been made together with an evaluation of various etching and observation techniques. All six etchants were found to produce usable pyramidal etch pits when special techniques were employed. A one-to-one correspondence in number and location has been established for the etch pits produced by all six etchants. On the basis of this correspondence, the only advantage in using one etchant in preference to another to study dislocations in sodium chloride appears to be ease of observation.

Author

N64-22024* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

APPROXIMATE ANALYSIS OF THE PERFORMANCE OF CHAR-FORMING ABLATORS

Robert T. Swann Washington, NASA, Jun. 1964 24 p refs

(NASA-TR-R-195) OTS: $0.75

Equations governing the performance of charring ablators, subject to a diffusion-controlled oxidation mechanism of char removal, are derived. A solution is presented for the case of a constant-enthalpy level. The effects of various material properties and environmental parameters are discussed.

Author

N64-22025* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DETERMINATION OF EFFECTS OF OXIDATION ON PERFORMANCE OF CHARRING ABLATORS

Marvin B. Dow and Robert T. Swann Washington, NASA, Jun. 1964 35 p refs

(NASA-TR-R-196) OTS: $1.00

An investigation of phenolic-nylon specimens was conducted in an atmospheric-pressure subsonic electric-arc-powered jet using gas streams of nitrogen and different oxygen concentrations. No char removal was observed for specimens tested in nitrogen; therefore, oxidation appears to be the only

mechanism of char removal for these specimens. With sufficiently high heating rates and low total heat input, the results can be correlated in terms of a diffusion limited mechanism. The results of tests with larger total heat input are discussed. A surface energy balance of the heat input and of the heat accommodated by various mechanisms is calculated. With oxygen concentrations of 11.5% and higher, the heat input resulting from combustion is a significant part of the total heat input. The effectiveness of a charring ablator as determined by the time required to achieve a certain back surface temperature rise is strongly influenced by the oxygen concentration in the test stream. The effectiveness of phenolic nylon tested in nitrogen is more than 70% higher than the effectiveness of the same material tested in air. Author

N64-22184 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
POPPED PEARLITE AND ARTICLES BASED THEREON
9 May 1963 13 p Transl. into ENGLISH from the Publ. "Vspuchennyy Perlit i Izdeliya Na Ego Osnova" Kiev, Akad. Stroitel'stva i Arkhitektury USSR, 1961 p 1–10
(FTD-TT-63-354/1+2+4; AD-409040)

Popped-pearlite sand is refractory, nonabsorbent, chemically inert, biologically stable, and odorless. It has a unit weight of 80 to 200 kg/m^3 and a thermal conductivity of 0.04 to 0.05 kcal/m/hr/deg. The sand is of inorganic origin and is obtained by the rapid firing of certain volcanic vitreous pearlitic rock, in a suspended state, at a temperature of 900° to 1,150° C. Popped pearlite is used in the manufacture of heat- and sound-insulating mortars and cements, in hydroinsulation, and as an additive to textured paint. I.v.L.

N64-22189 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATING PLASTIC BEARINGS WITH INVERTED FRICTION COUPLING
A. A. Lebedev 27 May 1963 9 p Transl. into ENGLISH from the Book "Plastmassy V Mashinostroyenii i Prioborostroyenii" Gostekhizdat, 1961 p 335–340
(FTD-TT-63-242/1+2; AD-409561)

A bearing with inverted friction coupling is discussed. The antifriction material— wood pulp–lamellar plastic DSP-V with crisscross arrangement of the veneer sheet— was applied on the shaft, (not on the insert). Results of experiments on these bearings include the following: (1) The work of the bearing, during lubrication with mineral lubrications of the machine-oil type, is stable and gives a minimum friction coefficient at v = 0.7 to 2.8 m/sec and p = 25 to 30 kg/cm^2. (2) There is an optimum amount of lubrication for each friction coefficient. A further increase in the amount of the delivered lubrication does not offer a temperature reduction of the most heated zone in the bearing nor a reduction in the friction coefficient. (3) The optimum angle of lubrication delivery from the viewpoint of reducing the friction coefficient and temperature of the most heated zone appears to be an angle of 180° to 210°. (4) The temperature and friction coefficients decrease with a reduction in relative gap from 0.03 to 0.012 at oil lubrication. I.v.L.

N64-22205 Rensselaer Polytechnic Inst., Troy, N.Y.
GROWTH TWINNING IN CERAMIC SYSTEMS
R. C. DeVries and D. Jugle Dec. 1963 39 p refs
(Contract Nonr-591(18))
(AD-434228)

Experiments aimed at controlling the microstructure of $BaTiO_3$ and relating the properties to the characterized microstructures in samples of high density are discussed. A second area of research is devoted to understanding in single crystals the interaction of defects with another kind of twin—the electrical or 180° twin. In summarizing the first area of investigation, general observations and results of studies of polycrystalline $BaTiO_3$ are presented along with a discussion of growth twinning in $BaTiO_3$ ceramics. In the second section, some etched structures are described, and their relationship to the sidewise motion of the 180° electrical twins or domains in $BaTiO_3$ is shown. P.V.E.

N64-22207 Imperial Coll. of Science and Tech., London (Gt. Brit.)
KINETICS OF THERMAL AND PHOTOCHEMICAL DECOMPOSITION OF SOME ALKALI METAL AZIDES Final Technical Report
F. C. Tompkins, P. W. M. Jacobs, and A. R. Tariq Kureishy 31 Jan. 1964 73 p refs
(Contract DA-91-591-EUC-2059)
(AD-432035)

Reproducible results for the thermal decomposition of sodium azide have been obtained by the following: (1) precipitating the salt as a fine powder from aqueous solutions acidified with hydrazoic acid; and (2) decomposing it in the form of small pellets, preferably under argon. When these precautions are observed, the kinetics obey the Avram–Erofeev equation with n = 2. An alternative method of finding the activation energy of the reaction without fitting the results to a kinetic equation is introduced. Both methods yield a value of 38 kcal/mole for the activation energy for the thermal decomposition of sodium azide. OH^- and Cl^- ions retard the reaction, but Fe^{3+} ions catalyze it. A mechanism for the reaction is postulated that explains these and previously observed facts. N.E.A.

N64-22254 Boeing Co., Seattle, Wash.
GRAPHITE Final Mechanical Properties Report
R. G. Edwards 30 Nov. 1963 51 p refs Prepared by Chance Vought Corp., for Boeing Co.
(Contract AF 33(657)-7132)
(Rept.-311.24; AD-433925)

This report contains the test data obtained on RT0029(RVC) graphite. Described are the following: (1) the final allowables test program conducted; and (2) the tests conducted to evaluate secondary effects on the strength of graphite, such as recoating, preheating, and moisture saturation followed by freezing. The results of statistical analysis of the graphite test data to establish the probability of failure are presented. Tabulated detailed test results are also presented, and the appendix contains typical stress–strain curves for the various types of specimens tested in the program. The final mechanical properties of RT0029(RVC) graphite, used to design the X-20 nose-cap graphite shell, are reported. N.E.A.

N64-22314 Battelle Memorial Inst., Columbus, Ohio
REFRACTORY CERAMICS OF INTEREST IN AEROSPACE STRUCTURAL APPLICATIONS —A MATERIALS HANDBOOK Technical Report, Apr. 1963–Apr. 1964
J. F. Lynch, A. Rudnick, D. J. Bowers, F. C. Holden, and W. H. Duckworth Wright-Patterson AFB, Ohio, Res. and Tech. Div., May 1964 71 p refs
(Contract AF 33(657)-8326)
(RTD-TDR-63-4102, Suppl. I; AD-600588)

Refractory-ceramic property data are presented. The handbook covers nonmetallic inorganic crystalline materials with melting points above 2,730° F (1,500° C), including intermetallic compounds and excluding glass, carbon, and graphite. The data are from literature published in 1961 and 1962. Detailed

properties are presented of the following materials: borides, carbides, nitrides, single oxides, mixed oxides, sulfides, and intermetallics. A critical discussion of analytical techniques for describing the strength characteristics of brittle materials is included. R.T.K.

N64-22333 Brown U., Providence, R.I. Div. of Engineering
A STUDY OF THE EFFECT OF VIBRATIONS ON THE WETTABILITY OF SOLID PARTICLES Final Report, 1 Jun. 1960–31 May 1963
J. Gurland 31 May 1964 5 p refs
(Contracts DA-ORD-28; DA-ORD(D)-31-124-G36)
(AROD-2262-6; AD-440356)

Included are reports on the following: (1) vibratory sintering of WC-Co alloys; (2) thin-film study of carbide single crystals; (3) relation of fracture strength and composition of sintered WC-Co alloys; (4) sintering mechanism of cemented carbides; and (5) quantitative metallography. R.T.K.

N64-22505 Stanford Research Inst., Menlo Park, Calif.
DIELECTRIC THIN FILMS WITH INCREASED BREAKDOWN STRENGTH Final Report, 1 Jun. 1961–31 Mar. 1964
Saul W. Chaikin and Gilbert A. St. John 15 Apr. 1964 139 p refs
(Contract DA-36-039-SC-87460)
(AD-600316)

Substrate surfaces were studied to determine blemish detail and contribution to capacitor failure. Best surfaces for capacitor construction resulted from drawn glass and flowed glaze. An adequate cleaning procedure is outlined. The first metal electrode must be specular. High substrate temperature and slow rate of evaporation contribute to rough metal films. SiO capacitors deposited at 1 to 4 A per sec had a much lower leakage than those deposited at 35 A per sec. A yield test with SiO dielectric resulted in 100 capacitors at 10,000 A thickness that withstood 50 v peak a.c. without breakdown, and 59 capacitors of 1,300 A that withstood 10 v. Continuing life tests with 47 v d.c. and 10 v d.c. resulted in no permanently shorted capacitors after 140–277 days. No evidence for voids (pin-holes) in SiO was found. MgF_2 dielectric gave poor reproducibility, confirming contradictory published reports. Dissipation varied from 0.01 to 0.7 dielectric constant from 5.6 to 16.5. Fabrication variables, MgF_2 manufacture, purity, outgassing, substrate temperature, degree of vacuum, and dielectric thickness could not be correlated with the production of bad capacitors. The ThFj dielectric had an average strength of 7.3 v/1,000 A. The causes of variation of dissipation factor were unknown. Radiant heating of the source produced capacitors with the lowest dissipation, and elevated substrate temperature of the source, the highest. The dielectric constant ranged from 8.8 to 18.4, correlating directly with the dissipation factor. Author

N64-22526 Princeton U., N.J. Frick Chemical Lab.
THE VISCOELASTIC PROPERTIES OF A ZINC PHOSPHINATE POLYMER
A. D. Mair, M. C. Shen, and A. V. Tobolsky May 1964 15 p
(Contract Nonr-1853(07))
(ONR-TR-RLT-77; AD-600431)

The viscoelastic behavior of an inorganic glass, the coordination polymer $Zn(OP(Ph)(Me)O)_2$, was investigated by a ball-indentation method. The polymer exhibited the properties of a Maxwell body, the shear compliance, J(t), at T_g = 51° C being given as a function of time, t, by the equation $J(t) = 7 \times 10^{-11} + 7.7 \times 10^{-16}t$. The temperature dependence of the melt viscosity is of the Arrhenius form over the temperature range considered, giving an apparent activation energy of 74 kcal/mole for viscous flow, but does not agree with that predicted by the WLF equation in its usual form. From considerations of its intrinsic viscosity in benzene and its viscoelastic behavior, it is concluded that the polymer is of low molecular weight. Author

N64-22545 Princeton U., N.J. Frick Chemical Lab.
RUBBER ELASTICITY OF PRESWOLLEN POLYMER NETWORKS: HIGHLY CROSSLINKED VINYL-DIVINYL SYSTEMS
M. C. Shen and A. V. Tobolsky May 1964 27 p refs
(Contract Nonr-1858(07))
(ONR-TR-RLT-79; AD-600432)

The elasticity of highly crosslinked, preswollen network polymers is studied. Copolymers of tetraethylene glycol dimethacrylate with ethyl acrylate, n-butyl acrylate, methyl methacrylate, and styrene, covering the whole range of composition, are investigated. Dioctyl phthalate is used to preswell the polymers up to 50% by volume. Both shear moduli and front factors are found to increase with increasing crosslink concentration, but decrease with increasing diluent content. Crosslinking efficiencies are determined by a modified Lashaek–Fox method. They are relatively invariant with the degree of preswelling. Factors contributing toward these observations are discussed. Author

N64-22553 Cincinnati U., Ohio
THERMAL CONDUCTIVITY AND TOTAL EMISSIVITY MEASUREMENTS IN THE TEMPERATURE RANGE 1000–3000° C Technical Documentary Report, Dec. 1962–Feb. 1964
Michael Hoch Wright-Patterson AFB, Ohio, AF Materials Lab., Apr. 1964 19 p refs
(Contract AF 33(616)-7123)
(ML-TDR-64-59; AD-601315)

The ratio of thermal conductivities (k_z/k_r) and of thermal conductivities to total emissivities (k_z/ϵ and k_r/ϵ) have been measured for anisotropic ZT-type graphite in the temperature range 1,000° to 2,000° C. The emissivity of a sample changes even if it is stored at room temperature for a long time. To obtain the total emissivity of a material, the ratio of specific heat to total emissivity is determined for tantalum, tungsten, molybdenum, and niobium in the temperature range 1,000° to 2,000° C. In all cases, it is found that C_p/ϵ is a constant, independent of temperature. This permits an easy and accurate determination of the total emissivity of any material. Author

N64-22554 General Dynamics/Astronautics, San Diego, Calif.
THERMOPHYSICAL PROPERTIES OF PLASTIC MATERIALS AND COMPOSITES TO LIQUID HYDROGEN TEMPERATURE (−423° F) Technical Documentary Report, Jul. 1962–Feb. 1964
James F. Haskins, Malcolm D. Campbell, Julius Hertz, and Joseph L. Percy Wright-Patterson AFB, Ohio, AF Materials Lab., Jun. 1964 179 p refs
(Contract AF 33(657)-9160)
(ML-TDR-64-33, Pt.I; AD-601337)

Existing room-temperature test methods for the determination of specific heat, thermal conductivity, and thermal expansion were modified so that measurements could be made at temperatures down to −423° F. Seventeen materials were evaluated. Thermal conductivity measurements on laminated materials parallel to a continuous reinforcement were as much as four times as high as measurements made normal to reinforcement. The use of higher conductivity reinforcements resulted in higher conductivity laminates. Thermal expansion

measurements on laminated materials showed that, in the direction normal to the reinforcement, the component with the largest coefficient of thermal expansion has the greatest influence on the overall expansion. In directions parallel to the reinforcement, the expansion of the higher modulus component controlled the overall expansion. Difficulties were encountered in determining the specific heat properties of the test materials at low temperatures. Test methods, problem areas, and preliminary data are discussed. Author

N64-22592 McDonnell Aircraft Corp., St. Louis, Mo.
DETERMINATION OF THERMAL CONDUCTIVITY AND LAP SHEAR STRENGTH OF ECCOBOND 56C AND 70C ADHESIVES Final Report
10 Jun. 1964 20 p
(Contract AF 33(657)-11215)
(A750; AD-441128)

Lap shear strengths were determined by bonding 2024-T3 aluminum panels with each of the materials to be tested. The lap shear strength of Eccobond 56C was 638 psi after air curing for 7 days, and 895 psi after heat during at 130° F for 24 hours. The lap shear strength of Eccobond 70C was 235 psi after air curing, and 511 psi after heat curing. The thermal conductivity of Eccobond 56C, by the bar method, varied from 7.0 to 15.5 Btu/ft^2-hr-°F/in. in the temperature range of 234° to 292° F with an average value of 10.7. No data could be obtained for Eccobond 70C, because the specimen broke during heating. The hot-plate method indicated that the thermal conductivity of Eccobond 56C was 2.6 Btu/ft^2-hr-°F/in. at 212° F, and 3.1 Btu/ft^2-hr-°F/in. at 415° F. The thermal conductivity of Eccobond 70C, determined by this method, was 2.6 Btu/ft^2-hr-° F/in. at 201° F and 3.0 Btu/ft^2-hr-° F/in. at 437° F. Author

N64-22593 McDonnell Aircraft Corp., St. Louis, Mo.
STRUCTURAL ABLATIVE AND DENSITY EVALUATION—MX2625 MOLDED AT VARIOUS PRESSURES Final Report
10 Jun. 1964 38 p
(Contract AF 33(657)-11215)
(A751; AD-441129)

A molding material, MX2625, is composed of chopped silica fibers impregnated with phenolic resin. The pressure recommended to mold a part using this material is 2,000 psi. Since 2,000 psi pressure requires expensive tooling to produce a part and less expensive tooling can be used if this pressure is reduced, tests were conducted to determine the variation of certain properties as affected by reduced molding pressure. Ablative tests using an air-arc plasma, tensile tests at room and elevated temperature, density tests, and hardness tests were performed on MX2625 molded at 350, 500, 750, 1,000, and 1,550 psi. The test results indicated that where the molding pressure of MX2625 was 750 psi or lower a significant decrease in the effective heat of ablation and in tensile strength was evident. Density decreased from 110.9 to 108.5 lbs/cu ft and hardness from R_E 109 to 94 as the molding pressure was decreased from 1,550 to 350 psi. Author

N64-22594 McDonnell Aircraft Corp., St. Louis, Mo.
EVALUATION OF O'RINGS FOR COMPATIBILITY WITH 90 PERCENT HYDROGEN PEROXIDE AT 150°F Final Report
10 Jun. 1964 7 p
(Contract AF 33(657)-11215)
(A752; AD-441130)

Compatibility tests were performed on eight types of O-rings to determine if they were suitable for service in a 90% hydrogen peroxide system at 66° C. The compatibility was based on the percent active oxygen loss, determined by immersing the specimen in 90% hydrogen peroxide liquid for 1 week at 66° C, and the percent stability determined by maintaining 50 cc of the remaining peroxide at 100° C for 24 hours. The test results revealed that only one of the eight O-rings was acceptable for use in 90% hydrogen peroxide systems. Author

N64-22626 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FOAMED PLASTICS ON A BASE OF ORGANOSILICON RESINS AND THEIR COMBINATIONS WITH ORGANIC POLYMERS
M. Ya. Borodim, Z. i, Kazakova et al 1 Mar. 1962 6 p Transl. into ENGLISH from the book "Khimiya i Prakticheskoye Primeneniye Kremneorganichezkikh Soyedineniy" Leningrad, 1958 p 304–306
(FTD-TT-62-1654/1+4; AD-401364)

The properties of organosilicon foamed plastics are elucidated, and their possible uses are evaluated. Two types of organosilicon resins are discussed; resins of foamed plastics and resins of acetyl siloxanes. Organic foamed plastics have the greatest strength at normal temperatures. With a rise of temperature, their strength begins to drop rapidly. At normal temperatures, the strength of aluminum foamed plastics is substantially higher than ordinary foamed plastics. This advantage is retained at high temperatures also. The strength properties of foamed materials containing aluminum do not change over the temperature range from 200° to 450° C. P.V.E.

N64-22630 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINING ELECTRICAL PROPERTIES OF GRAPHITE AT HIGH TEMPERATURES
L. F. Mal'tseva and E. N. Marmer 14 Feb. 1963 11 p refs Transl. into ENGLISH from Poroshkovaya Met. (USSR), no. 1, 1962 p 50–55
(FTD-TT-62-1708/1+2; AD-401730)

This investigation was carried out to determine the values of specific electrical resistance in temperatures ranging from 20° to 2,500° C for industrial graphite. A brief description of the testing installation is given. N.E.A.

N64-22689 Midwest Research Inst., Kansas City, Mo.
THERMOPHYSICAL PROPERTIES OF THERMAL INSULATING MATERIALS
J. B. Loser, C. E. Moeller, and M. B. Thompson Wright-Patterson AFB, Ohio, AF Materials Lab., Apr. 1964 362 p refs
(Contract AF 33(657)-10478)
(ML-TDR-64-5; AD-601535)

This handbook is a compilation of thermophysical property data of insulating materials, which can be used in both cryogenic and high-temperature applications. Thermal conductivity, linear thermal expansion, specific heat, total normal emittance, thermal diffusivity, and compressive strengths are plotted with respect to temperature. Density, melting point, continuous service temperature, typical available form, and modulus of elasticity are given in tabular form in a general properties table. The data listing is arranged alphabetically, and by form (powders, foams, multiple layers, etc.). Various experimental methods for determining thermal properties are described, and their accuracies are indicated. Author

N64-22720 Aeon Labs., Egham (Gt. Brit.)
THE STRUCTURE OF GRAPHITIC MATERIALS—4 Final Technical Report, 1 Oct. 1963–29 Feb. 1964

W. K. Armitage 17 Mar. 1964 41 p refs
(Contract DA-91-591-EUC-1851)
(AD-600760)

This report discusses electron microscopic observations of synthetic graphite materials in both the ungraphitized and graphitized forms (heated at 2,500° C) after various heat treatments and high-temperature creep deformations. Moiré fringe effects were reconciled with a turbostratic structure in which grains of graphite are subdivided into stacks of crystallites that are narrow in their c-direction and have small angular rotations in their respective basal planes. Electron diffraction patterns from this structure show ring effects when the layer structure is normal to the electron beam, and elliptical effects when the beam is not normal to the layers. As the heat treatment temperature is raised, the diffraction rings, or ellipses, become progressively spotty as the crystallites grow, and misorientations in the basal planes, are minimized. Finally, after heat treatment at 2,850° C, single-crystal spot patterns are observed, indicating that either the misorientations have almost disappeared or that the crystallite size has increased greatly. I.v.L.

20 MATHEMATICS

Includes calculation methods and theory; computers; data processing; and numerical analysis. *For related information see*: 08 Communications; 09 Electronics; 10 Facilities, Research and Support; and 22 Navigation and Guidance.

N64-21500 Aberdeen Proving Ground, Md. Ballistic Research Labs.
A MACHINE PROGRAM FOR COMPUTING NONLINEAR VISCOELASTIC WAVE PROPAGATION IN SOILS
Millicent M. Beck Jan. 1964 46 p refs
(BRL-1237; AD-438168)

A numerical method and its machine program for calculating nonlinear viscoelastic wave propagation in soils are described. Solutions give particle velocity, stress, and strain as functions of time and distance from the stress source. Author

N64-21504 Naval Radiological Defense Lab., San Francisco, Calif.
REVERSIBILITY OF THE LIOUVILLE EQUATION AND THE APPROACH TO EQUILIBRIUM
B. Leaf and W. C. Schieve 20 Mar. 1964 37 p refs
(USNRDL-TR-734; AD-437899)

Two real solutions for the Liouville equation exist for a system whose number of degrees of freedom $N \rightarrow \infty$ and volume $V \rightarrow \infty$ with N/V finite. One solution is obtainable from the other by replacing τ, the time elapsed from the initial state by $-\tau$. Reversibility requires the existence of both solutions. This is the solution that describes the approach to equilibrium in the work of Prigogine's group. The other solution that diverges as $\tau \rightarrow \infty$ is not allowed physically. The admission of only one of the two solutions introduces irreversibility. The convergence of the allowed solution as $\tau \rightarrow \infty$ results from the continuous character of the spectrum of the Liouville operator in the infinite limit, which gives rise to a Cauchy integral in the distribution function of the infinite system. The result that the distribution function for the entire infinite system converges as $\tau \rightarrow \infty$ is obtained without the use of perturbation theory. The result does not require specific initial conditions or assumptions about the nature of the singularities of the Cauchy integral. The evolution of an infinite system is governed by a Hermitian transformation instead of a unitary transformation as for a finite system. In the infinite limit the Liouville operator becomes anti-Hermitian. Solutions of the adjoint Liouville equation and the inhomogeneous Liouville equation for infinite systems are also described. Author

N64-21522 International Business Machines Corp., Bethesda, Md. Federal Systems Div.
OPTIMIZED DIGITAL AUTOMATIC MAP COMPILATION SYSTEM Third Interim Report, 1 Aug.–1 Nov. 1963
F. D. Schulman, W. C. Lanier, F. L. Holmes, and J. V. Sharp 30 Nov. 1963 24 p
(Contract DA-44-009-AMC-111(X))
(IR-3; AD-432243)

The upgraded digital automatic map-compilation scan-record system became operational; an overall improvement in the operational characteristics of the system was achieved. Specifically, the improvement in signal-to-noise ratio was accomplished by selection of improved photomultiplier tubes, and to some degree by the design of the new amplifiers. The quantizing capabilities of the system, both in the range of densities and the number of gray levels, was greatly extended. The X-correction circuitry essential for accurate spot placement is the only area still providing difficulties. Each of the correlation methods, viz, successive parallax approximation, phase alignment, and feature matching, reached a stage in the development cycle where meaningful test results are becoming available. The predictive logic system produced a distributed set of measurements that, when manually contoured, accurately depict the lay of the land. D.S.G.

N64-21526 Rand Corp., Santa Monica, Calif.
THREE NEW COMPUTATIONAL METHODS FOR SOLVING TWO POINT BOUNDARY VALUE PROBLEMS
Kenneth B. Bley Mar. 1964 14 p refs
(P-2878; AD-433279)

In transforming two-point boundary value problems into forms more readily solved numerically, three methods are found to be of practical use: quasi-linearization, dynamic programing, and invariant imbedding. Each of these methods is explained through the use of a mathematical example and discussed from the standpoint of advantages and disadvantages to the user. A.W.

N64-21530 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France)
INTEGRAL EQUATIONS FOR CLASSICAL FLUIDS AND THE LATTICE GAS
Dominique Levesque and Loup Verlet May 1964 6 p refs
(Supported by AF-EOAR)
(TH-53/15)

Various integral equations have been proposed to calculate the two-body correlation function of classical fluids. Application is made of two of these to lattice gas interacting with its nearest neighbors. One of these equations, the so-called HNC (hyper-netted chain) may be obtained either by summing up the terms of the cluster expansion of the correlation function or by Percus' method which may also be used to derive the second equation known as the PY (Percus–Yevick) equation. Both the HNC and PY equations are evaluated in terms of three-dimensional, two-dimensional, and one-dimensional cases. A.W.

N64-21546 RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING, INVARIANT IMBEDDING AND QUASILINEARIZATION: COMPARISONS AND INTERCONNECTIONS

R. E. Bellman and R. E. Kalaba Mar. 1964 21p refs
(Contract AF 49(638)-700)
(RM-4038-PR; AD-431866)

A nonlinear two-point boundary value problem arising from a variational context is considered from several points of view. First, a direct computational solution via quasi-linearization is discussed. This method is quadratically convergent. The boundary value problem is then converted into an initial value problem using dynamic programing and invariant imbedding. Some aspects of combining the methods in a single calculation are discussed, giving rise to attractive predictor–corrector integration schemes. In addition, an alternative to the usual Hamilton–Jacobi integration theory for the integration of the Euler equation is given. Author

N64-21567 General Electric Co., Philadelphia, Pa. Re-Entry Systems Dept.
SOLVING NUMERICALLY THE NAVIER-STOKES EQUATIONS
L Crocco 20 Mar. 1964 39 p refs
(Contract AF 04(694)-222)
(Rept.-63SD891; AD-439220)

It is desirable to develop a method of treating viscous, conducting flows in which no arbitrary assumptions (i.e., boundary-layer approximations) are required, to solve the complete Navier–Stokes equations. This report presents the details of a new method in which such a numerical procedure is developed; the resulting finite difference equations are analyzed for stability, and the method is then applied to the determination of the viscous one-dimensional flow field in a supersonic nozzle containing a normal shock wave. Author

N64-21584 Computronics, Inc., Teaneck, N.J.
SIMULATION SYSTEM PROGRAMMING DESIGN MANUAL
Dec. 1963 127 p refs
(Contract N61339-1089)
(NAVTRADEVCEN-1089-1; AD-439418)

This manual treats the system-analysis and computer-programing problems of real-time system simulation. The topics considered are applicable to system simulation for design, analysis, or training purposes. Emphasis is placed on real-time applications because of the special constraints imposed on the digital computer by real-time use. The technical discussion covers concepts and techniques applicable to a broad range of simulation problems. System analysis, real-time digital computer systems, mathematical models, equations, dynamics, kinematic and empirical, input–output program design, control program design, and program writing are among the technical areas covered. Project management and control are treated as a separate topic. To illustrate the application of the ideas developed to a specific problem, there is a detailed example showing the steps in the design of a hypothetical CIC simulation system. A bibliography is included listing books and technical articles treating more fully many of the topics covered in the manual. Author

N64-21620 RAND Corp., Santa Monica, Calif.
NUMERICAL STUDIES OF A TWO-POINT NONLINEAR BOUNDARY VALUE PROBLEM USING DYNAMIC PROGRAMMING, INVARIANT IMBEDDING, AND QUASILINEARIZATION
R. E. Bellman, H. H. Kagiwada, and R. E. Kalaba Mar. 1964 104 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-4069-PR; AD-434561)

The theories of quasi-linearization, dynamic programing, and invariant imbedding are applied to the numerical solution of a single variational problem. Their advantages and disadvantages are discussed, and FORTRAN programs and numerical results are included. Author

N64-21660 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ABSOLUTE INVARIANCE AND INVARIANCE TO E IN THE THEORY OF DIFFERENTIAL EQUATIONS. I
N. N. Luzin and P. I. Kuznyetson 17 Mar. 1964 4 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, v. 51, no. 4, 1946 p 247–249
(FTD-MT-63-322; AD-409008)

A system of differential equations (S) is considered where a_{ij} are polynomials with constant coefficients of the second degree relative to the letter D, $D = \frac{d}{dt}$, and where f(t) is an arbitrary analytic function, holomorphic for $t = t_0$. It is assumed that the determinant $D = a_{ij}$ of the system is not identical to zero. It is shown that the necessary and sufficeint condition for the first unknown function $x_1(t)$ of system (S) to be independent of the arbitrary analytic function f(t) consists of identical annihilation of minor D_{11}. This leads to the theorem that if the criterion of absolute invariance for x_1 is satisfied for the system (S), and if this system allows a solution $(x_1, x_2, \ldots, x_n)$ with zero initial conditions $[x_i(t_0) = 0, x_i(t_0) = 0]$ for any analytic function f(t) holomorphic at point t_0, then it necessarily follows that the identity $x_i(t) = 0$ in any interval (a,b) of the holomorphism of function f(t) containing point t_0. M.P.G.

N64-21688 RAND Corp., Santa Monica, Calif.
A GUIDE TO THE GENERAL PROBLEM-SOLVER PROGRAM GPS-2-2
Allen Newell Feb. 1963 156 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3337-PR; AD-297849)

The gross topography of the program is presented and includes a runthrough of a simple problem to put the parts in context. The various data structures are discussed—goals, expressions, derivation lists, operators, location programs, and differences. A detailed description is given of the subroutine hierarchy, working from the top executive down through the technique of method interpretation to a consideration of each method and method segment. Also described is the Experimenter, i.e., the embedding program used to put GPS into operation and to output selected aspects of its performance. The information provided for each task enviroment is discussed. Author

N64-21715 RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING AND ILL-CONDITIONED LINEAR SYSTEMS
Richard Bellman, Robert Kalaba, and Joanne Locket Dec. 1963 30 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3815-PR; AD-426455)

Dynamic programing, successive approximations, extrapolation, and smoothing are used to treat ill-conditioned systems. Numerical examples are given. Author

N64-21732 European Organization for Nuclear Research, Geneva (Switzerland)
A COMPUTER PROGRAMME FOR THE SOLUTION OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS (POTENTIAL PROBLEMS)

J. S. Hornsby 26 Mar. 1963 47 p refs
(CERN-63-7)

This program solves equations of the form:

$$a\delta^2u/\delta x^2 + b\delta^2u/\delta y^2 + c\delta u/x + d\delta u/y + eu + f = 0$$

where a·b = 0 and a, b, c, d, e, f may be functions of x, y, and u. The solution will be found within a region bounded by simple closed curves C_1, C_2.....C_k, where C_2, C_3.....C_k lie within the domain bounded by C_1. Along any segment of each C_j either (1) u must be known, or (2) if the segment is straight, a net can be chosen so that the segment is coincident with a nodal line, a condition of the form

$$p\,\delta u/\delta x + q\,\delta u/\delta y + ru + s = 0.$$

Author

N64-21750 Arcon Corp., Lexington, Mass.
A METHOD FOR COMPUTING LEAST SQUARES ESTIMATORS THAT KEEP UP WITH THE DATA
Arthur Albert and Robert W. Sittler Feb. 1964 34 p refs
(Contract Nonr-4401(00))
(AD-434715)

A method is given for computing a least-square estimator in real time. In addition, a method is presented whereby a least-square estimator subjected to certain linear constraints can be computed. A procedure is given for evaluating the residual error after a least-square estimate, either constrained or unconstained, has been computed. R.T.K.

N64-21751 Arbeits- und Forschungsgemeinschaft Graf Zeppelin, Stuttgart (W. Germany)
THE DIGITAL MEASUREMENT TECHNIQUE FROM VIEWPOINT OF THE PRODUCER OF MEASURING INSTRUMENTS [DIE DIGITALE MESSTECHNIK AUS DER SICHT DES MESSGERATEHERSTELLERS]
H. Schneider (Wandel and Goltermann, Reutlingen) [1963] 62 p Presented at the 63rd Meeting on Aeronautics, Stuttgart, 12 Sep. 1963 In GERMAN

The components, operation, and storage possibilities of digital measuring systems, which measure a selected physical magnitude, are discussed along with the mechanics of analog–digital converters. Also, the components and operation of an ANDIMAT, a specific type of analog–digital converter, are discussed. I.v.L.

N64-21770 International Business Machines Corp., Yorktown Heights, N.Y. Thomas J. Watson Research Center
EVALUATING THE LOGICAL DESIGN OF THE PROBLEM ORIENTED SYMBOL PROCESSOR Final Report (Appendix)
R. F. Schauer and J. E. Meggitt 1 Nov. 1963 337 p
(Contract AF 19(628)-3257)
(AFCRL-64-198; AD-600014)

Included in this appendix are the microprogram assembly decks, and the 7094 interpretive programs used to simulate the ADAM microcomputer. There are nine interpretive programs: INTRC, LOADF, ENDPR, MICPR, INPF *MAIN*, PRINT, TRACE, SETAB, and INSEQ. These programs are listed, and the FAP symbolic decks for each of the microprogram read-only-memory pages are given. The mnemonics and constants used by each of these programs are found in the assignment deck. Author

N64-21788 Brown U., Providence, R.I.
TOEPLITZ OPERATORS ON LOCALLY COMPACT ABELIAN GROUPS
Henry Alan Krieger Mar. 1964 60 p refs
(Grant NSF-E791)
(AD-434244)

Let G be a nondiscrete locally compact Abelian group, let Γ be its noncompact dual group, and let m and μ be Haar measures on G and Γ, respectively, normalized so the Fourier inversion theorem holds. This asymptotic eigenvalue distribution theorem is extended in several ways. First of all, the class of sequences $\{W_n\}$ for which the result holds is examined and found to be quite extensive. Secondly, several generalizations of the finite Toeplitz operator generated by a function $f \epsilon L^1(G)$ are considered, and corresponding results on the asymptotic distribution of eigenvalues are obtained for most of these operators. Finally, a further extension of these results is made to the case in which Γ is not compactly generated. Author

N64-21792 Aberdeen Proving Ground, Md. Ballistic Research Labs.,
BRLESC FORTRAN
Lloyd W. Campbell and Glenn Beck Nov. 1963 52 p
(BRL-1229; AD-434670)

FORTRAN is a popular programing language that has been implemented on many computers. It is now available on Ballistic Research Laboratories' BRLESC computer. This report describes the FORTRAN language in general and includes specific details about its implementation on BRLESC. Author

N64-21810 Naval Ord. Lab., White Oak, Md.
ON A MIXED BOUNDARY VALUE PROBLEM FOR LINEAR THIRD ORDER HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS
Sherwood C. Chu Jun. 1964 19 p refs
(NOLTR-64-70; AD-600101)

Consider the differential operator $\Omega(u)$ defined by $\Omega(u) = u_{xyz} + a_1u_{yz} + a_2u_{xz} + a_3u_{xy} + a_{23}u_x + a_{13}u_y + a_{12}u_z + a_{123}u$. Function u(x,y,z) is sought, which is a solution of $\Omega(u) = F(x,y,z)$ in a rectangular parallelepiped R and which satisfies certain boundary conditions on each of three surfaces lying in R. The boundary conditions are prescribed as linear combinations of the unkown function u and its pure mixed partial derivatives, up to the second order. By reducing the boundary-value problem to an equivalent system of integral equations, an existence and uniqueness theorem in the large can be obtained. Author

N64-21814 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Lab.
ON THE FIRST VARIATION OF THE SOLUTION TO BOUNDARY PROBLEMS IN THE THEORY OF THE POTENTIAL FOR THE VARIATION OF THE BOUNDARY SURFACE
V. A. Kronberg Jul. 1961 15 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 19, no. 4, 1955 p 463–470
(MH-TRANSL-292)

Potential theory (as in the text by Kellogg) and the differential geometry of surfaces in Euclidean, three-dimensional space were blended. Essentially, a smooth closed surface such that a Poisson-integral representation of the Dirichlet or Neumann problems is achievable was considered. Then, the surface in an obvious, differential-geometric manner was deformed and expressions for first variations of the potential function were obtained. Author

N64-21836 Society of Photographic Scientists and Engineers, Washington, D.C.
SEVEN PLACE COSINES, SINES AND TANGENTS FOR EVERY TENTH MICROTURN

Norton Goodwin Mar. 1964 80 p
Soc. of Phot. Sci. and Engr.: $2.00 Copyright

These tables differ from those previously available in that the sine and cosine values of a given argument appear on opposite pages, and decimal fractions of the period of these functions are the arguments. The tables were designed to facilitate desk-calculator transformations of the coordinates of artificial earth satellites, in particular. The arrangement of values is the one customary in logarithmic tables. Each page lists 500 arguments at 10-microturn intervals. Complete values are given only in the zeroth column. All tabulated values are positive. Rules for determining the senses and magnitudes of the various functions in the remaining three quadrants are given in an appendix. A.W.

N64-21853 RAND Corp., Santa Monica, Calif.
INCIDENCE MATRICES AND INTERVAL GRAPHS
D. R. Fulkerson and O. A. Gross Mar. 1964 44 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3994-PR; AD-432293)

A fundamental problem in genetics is expressed and solved in terms of matrices. The problem is to determine whether data from suitable experiments is consistent with the assumption that the subelements of genes are linked together in linear order. By examining data obtained from the experiments, it was determined whether or not the blemished portions of two mutant genes intersect, and this intersection data for a large number of mutants is represented as an undirected graph. When this graph is an "interval graph," the observed data is consistent with a linear model of the gene. R.T.K.

N64-21909 RAND Corp., Santa Monica, Calif.
ADAPTIVE CONTROL VIA QUASILINEARIZATION AND DIFFERENTIAL APPROXIMATION
R. Bellman, R. Kalaba, and R. Sridhar Nov. 1963 24 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3928-PR; AD-422713)

An adaptive controller is one that learns from experience and in so doing improves the quality of the control it exerts over a plant. Such a controller adapts itself to circumstances as it finds them. Suppose that a system undergoes a process described by a system of differential equations. The equations contain some unknown parameters, and not all the initial conditions are known. Observations are made on some of the state variables during the course of the process. It is desired that the system parameters and initial conditions that lead to best agreement with the observations be determined. Inverse problems of this type, which are important throughout mathematical physics and engineering, are cast in mathematical form as nonlinear, multipoint boundary-value problems. Then computational solutions via quasi-linearization and differential approximation are suggested. Author

N64-21916 RAND Corp., Santa Monica, Calif.
MATERIAL MOMENTUM-ENERGY TENSORS AND THE CALCULUS OF VARIATIONS
Dominic G. B. Edelen Feb. 1964 16 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3993-PR; AD-429969)

If the Einstein field equations of general relativity are derived from a homogeneous variational principle, then the dynamical processes of the space are intrinsically reversible. As an application, an isolated world tube of perfect fluid contains a geodesic stream line, provided the field equations are derived from a variational principle. Author

N64-21917 RAND Corp., Santa Monica, Calif.
THREE-POINT HYPERBOLIC EXTRAPOLATION TO SOLVE EQUATIONS
M. L. Juncosa Feb. 1964 16 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3975-PR; AD-430200)

Three-point parabolic extrapolation to iteratively solve real or complex algebraic or transcendental equations has been used frequently on automatic computers, particularly in determination of eigenvalues of matrices. It is suggested that three-point equilateral hyperbolic extrapolation enjoys the same reasons for adoptions as parabolic extrapolation, but has the added advantages that one avoids at each iteration a square root determination, a sign determination, and the necessity of guarding against the possibility of being thrust into the complex domain when seeking real roots of real equations. The order of convergence is the same as that of parabolic extrapolation. Author

N64-21958 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TRANSFORMER-TYPE DIFFERENTIAL ANALYZER FOR LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS
V. I. Usynin 14 Oct. 1963 5 p Transl. into ENGLISH from Soviet Patent no. 147369, 13 Apr. 1961 p 1-3
(FTD-TT-63-840/1+2; AD-425721)

The transformer-type differential analyzer for linear equations with constant coefficients is characterized by a functional circuit containing a unit that computes the integral equation of the Volterra II kind, relative to the zero derivative. This device is based on the use of multicoil transformers, as the basic operational units, which accomplish the function of a linear converter of the voltage supply to the input windings. N.E.A.

N64-22004 Washington U., Seattle
FACTOR ANALYSIS OF DATA MATRICE, PART V
Paul Horst Mar. 1964 185 p
(Contract Nonr-477(33); Grant MH00743-08)
(AD-434811)

This is part of a series of reports on rationales and techniques of matrix factoring that play an important role in multivariate analysis techniques. The following are discussed: (1) background—role of factor analysis in science, simple matrix concepts, matrix structure and solutions, and matrix factoring and approximation; (2) matrix factoring methods; and (3) categories, origin, scale, and image analysis. R.T.K.

N64-22016* Minneapolis-Honeywell Regulator Co., Minn.
ROCKET BOOSTER CONTROL. CONTROL OF PLANTS WHOSE REPRESENTATION CONTAINS DERIVATIVES OF THE CONTROL VARIABLE
W. W. Schmaedeke Wash., NASA, Jun. 1964 17 p refs
(Contract NASw-563)
(NASA-CR-49)

Problems of control of plants modeled by differential equations containing derivatives of the control (or forcing) functions are discussed. These right side plant dynamics in conjunction with relay-type jumps in the forcing functions require an analysis or synthesis method to accommodate derivatives of step functions. Previously this problem was avoided formally by transforming to a special set of coordinates in which only zero-order forcing terms appear. This paper develops a mathematical model for equations with derivatives of the control functions and establishes conditions under which the formal transformation referred to above can be rigorously applied. Author

N64-22064* Wisconsin U., Madison
GENERALIZATION OF LAPLACE'S EXPANSION TO ARBITRARY POWERS AND FUNCTIONS OF THE DISTANCE BETWEEN TWO POINTS
R. A. Sack (Royal Coll. of Advanced Tech.) Repr. from J. Math. Phys., v. 5, no. 2, Feb. 1964 p 245–251 refs
(Grant NsG-275-62(4180); Contract NONR-2121(01))

In analogy to Laplace's expansion, an arbitrary power r^n of the distance r between two points $(r_1,\partial_1,\Lambda_1)$ and (r_2,∂_2,ϕ_2) is expanded in terms of Legendre polynomials of cos ∂_{12}. The coefficients are homogeneous functions of r_1 and r_2 of degree n satisfying simple differential equations; they are solved in terms of Gauss' hypergeometric functions of the variable $(r_</r_>)^2$. The transformation theory of hypergeometric functions is applied to describe the nature of the singularities as r_1 tends to r_2 and of the analytic continuation of the functions past these singularities. Expressions symmetric in r_1 and r_2 are obtained by quadratic transformations; for $n = -1$ and $n = -2$; one of these has previously been given by Fontana. Some three-term recurrence relations between the radial functions are established, and the expressions for the logarithm and the inverse square of the distance are discussed in detail. For arbitrary analytic functions $f(r)$, three analogous expansions are derived; the radial dependence involves spherical Bessel functions of $(r_<\partial/\partial r_>)$ of related operators acting on $f(r_>)$, $f(r_1 + r_2)$ or $f[(r_1^2 + r_2^2)^{1/2}]$. Author

N64-22096 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
THE SOLUTION OF A LARGE ORDER LINEAR SYSTEM BY A DIFFERENCE EQUATION
Kolman W. Brand Dec. 1963 12 p refs
(RN-173)

A method is presented for finding the solution x_j, $j = 1, \ldots, n^*$, of a large-scale linear system given by the following equation:

$$\sum_{j=1}^{n^*} a_{ij}x_j = b_i,$$

for $i = 1, \ldots, n^*$ and with $n^* \geq 75$. An illustrative example is presented. The example involves the finding of the stress distribution in a hemispherical shell with holes. P.V.E.

N64-22097 Harry Diamond Labs., Washington, D.C.
SOME USEFUL NOTIONS IN LINEAR VECTOR SPACES
N. Karayianis 16 Mar. 1964 28 p ref
(TR-1187; AD-434564)

Three notions regarding operators in a linear vector space are introduced: (1) the order of an element x with respect to an operator A; (2) a null-preserving operator; and (3) an order-preserving operator. Several theorems regarding these concepts are proved. One theorem is the outgrowth, primarily, of the null-preserving notion, and it characterizes operators of simple structure, i.e., operators whose eigenvectors span the linear vector space. Such operators constitute a larger class than the so-called normal operators whose eigenvectors are known to form an orthogonal basis in the space. The notion of an order-preserving operator is investigated very briefly, and a possible application in the investigation of the symmetric group is suggested. Author

N64-22110 Los Alamos Scientific Lab., N. Mex.
TEWA. AN IBM CODE FOR COMPUTING THE MAXWELLIAN DOPPLER BROADENING OF BREIT-WIGNER RESONANCES
Lee Bordwell, Joseph J. Devaney, Marjorie Devaney, Bertha Fagan, and Max Goldstein 28 Jun. 1961 76 p refs
(Contract W-7405-ENG-36)
(LAMS-3075) OTS: $1.75

TEWA 2 is an IBM 704 code for folding a three-dimensional Maxwellian velocity into sums of single level Breit–Wigner resonance formulas. Linear level–level interference in elastic scattering is included. The results of TEWA are printed on listings and on magnetic tape and are punched on cards. The cards serve as input to COMANCHE-SUM-3, which is a code that reduces isotopic results to the results for the normal element, or for mixtures of isotopes. Author

N64-22116* Martin Co., Baltimore, Md. Rias Div.
A STABILITY THEOREM FOR FUNCTIONAL-DIFFERENTIAL EQUATIONS
Jack K. Hale [1963] 6 p refs Repr. from Proc. Natl. Acad. Sci. U.S., v. 50, no. 5, Nov. 1963 p 942–946
(Contracts NASW-718; AF 49(638)-1242; Nonr-3693(00))

For ordinary equations, it was shown previously that the limiting sets of bounded trajectories are contained in the largest invariant set, where the derivative of a Lyapunov function V vanishes, provided that V is bounded below and that the set where V is less than a constant is also bounded. It is the purpose of the present note to extend this result to functional differential equations. The term functional differential equation as used in this paper is a natural generalization of the concept of a differential equation with delayed arguments. N.E.A.

N64-22122 Harvard U., Cambridge, Mass. Cruft Lab.
ON THE PARTIAL DIFFERENTIAL EQUATION FOR THE CONDITIONAL PROBABILITY DISTRIBUTION FOR NONLINEAR DYNAMIC SYSTEMS WITH NOISY MEASUREMENTS
R. L. Kashyap 2 Dec. 1963 20 p refs
(Contract NONR-1866(16))
(TR-432; AD-434872)

The partial integro-differential equation was derived for the conditional probability density distribution of the output of a nonlinear system excited by nonadditive white gaussian noise, with nonlinear measurements corrupted by white gaussian noise. This equation reduces to the well-known Kolmogoroff forward equation when there are no measurements. The usefulness of the differential equation is demonstrated by deriving from it, for linear systems, the Wiener–Kalman filter. Author

N64-22123 System Development Corp., Santa Monica, Calif.
SOME EXAMPLES OF STOCHASTIC DISTORTION, A MONTE CARLO TECHNIQUE
E. L. Pugh 6 Mar. 1964 18 p ref
(SP-1584; AD-434020)

The effects of stochastic distortion on the sampling variance of a Monte Carlo estimation of tail probabilities is presented for both the exponential and the gamma distributions. Also presented is the effect of the distortion on the required sample size for a desired accuracy-confidence statement. Author

N64-22128 Illinois U., Urbana Coordinated Science Lab.
LINEAR CONTROL LAWS FOR SINGULAR LINEAR SYSTEMS
Manoel Sobral Jan. 1964 39 p refs
(Contract DA-36-039-AMC-02208(E))
(R-188; AD-433814)

For a class of quadratic performance indices the optimal control law is a combination of maximum effort (bang-bang) and singular. The singular control law is linear, and it is optimal in a hyperplane in the n-dimensional state space. For practical purposes it is desirable to restrict the class of admissible control laws to being linear. This investigation presents a method of finding a linear control law that is optimal in the sense that it is the singular control law in the singular surface and the best possible linear law elsewhere. Classical calculus of variations and the more sophisticated maximum principle of Pontryagin are the mathematical tools used; the former provides a simple and straightforward method for obtaining the singular solutions, and the latter is used to extend the linear singular law to the entire state space. Author

N64-22156 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE INSOLVABILITY OF THE PROBLEM OF HOMEOMORPHY
A. Markov 13 Apr. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 121, no. 2, 1958 p 218–220
(FTD-TT-64-125/1+4; AD-600501)

The following theorems and their corollaries are considered: (1) For each natural number $n > 3$, some n-dimensional manifold M^n can be shown so that the problem of finding manifolds homeomorphic to manifold M^n is insolvable. (2) For any natural number $n > 3$, the problem of the homotopic equivalence of manifolds to manifold M^n is insolvable. R.T.K.

N64-22178 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MOTION OF A BODY OF VARIABLE MASS WITH CONSTANT AND DECREASING EXPENDITURE OF POWER IN A GRAVITATIONAL FIELD. PART III [O DVIZHENII TELA PEREMENNOY MASSY S POSTOYANNOY I UBYVAYUSHCHEY ZATRATOY MOSHCHNOSTI V GRAVITATSIONNOM POLE. CHAST' III]
G. L. Grodzovskiy, Yu. N. Ivanov, and V. V. Tokarev 10 Feb. 1964 63 p refs Transl. into ENGLISH from the Russian
(FTD-TT-63-973/1+4; AD-435501)

This report deals with the following: (1) the optimization of the parameters of motion of a body of variable mass with a limited expenditure of power and with a nonlinear dependence of the weight of the power source on the power value; (2) the motion of a body of variable mass with limited power and a given action time; (3) the motion of a body of variable mass, in a gravitational field, with an active ejection of power (jet thrust); and (4) the construction of an optimum program, taking into account correction of acceleration from jet thrust, which insures a maximum average payload during the motion of a body of variable mass with a constant expenditure of power. I.V.L.

N64-22304 Air Force Cambridge Research Labs., Bedford, Mass. Electromagnetic Radiation Lab.
FOURIER COEFFICIENTS FOR TCHEBYSCHEFF PATTERNS
Charles J. Drane, Jr. Sep. 1962 16 p refs
(AFCRL-62-726; AD-287924)

The use of Chebyshev polynomials in the optimum design of linear, broadside arrays involves a tedious calculation of the coefficients that represent the currents in the array. Two new methods that can be used to simplify the computations for these Chebyshev coefficients are presented in this paper. Author

N64-22375 Midwest Research Inst., Kansas City, Mo.
APPROXIMATE SOLUTIONS OF NON-LINEAR DIFFERENTIAL EQUATIONS
Wyman G. Fair Wright-Patterson AFB, Ohio, Directorate of Systems Dyn. Analysis, Apr. 1964 23 p refs
(Contract AF 33(657)-10652)
(SEG-TDR-64-25; AD-601236)

Recursion relations are developed that can be used to compute the main diagonal Padé approximations to the solution of the Ricatti equation with rational coefficients. Convergence of these approximations is discussed for a limited class of solutions; examples and applications of the theory are presented. Author

N64-22376 Columbia U., New York, N.Y.
OPTIMUM CLASSIFICATION RULES FOR CLASSIFICATION INTO MULTIVARIATE NORMAL POPULATIONS
S. Das Gupta 26 Mar. 1964 27 p refs
(Contract NONR-266(33); Grant NSF-G5824)
CU-71-64; AD-601468)

This report demonstrates that the maximum likelihood classification rule is unbiased, admissible, and minimax when the common covariance matrix of the two normal populations is known and that, when the common covariance matrix is unknown, the corresponding maximum likelihood classification is unbiased and in an invariant class, is also minimax, and admissible. The loss function in each problem is assumed to be a function (satisfying some mild restrictions) of the Mahalanobis distance between the two populations. I.V.L.

N64-22389 Air Force Systems Command, Wright-Patterson AFB, Ohio
ARITHMETIC SIMULATION OF RANDOM PROCESSES
A. G. Postnikov 4 Jun. 1963 102 p refs Transl. into ENGLISH from the book, "Arifmeticheskoye Modelirovanyye Sluchaynykh Protsessov" Moscow, Izd. An SSSR, 1960 p 1–84; Tr. Mat. Inst., An SSSR, v. 57
(FTD-TT-62-1367/1+2; AD-414717)

That a completely uniformly distributed sequence may be used to construct a sequence that is completely distributed with respect to a function F(x) is shown. Diophantine approximations with exponential functions are used in developing the theorems and proofs presented. P.V.E.

N64-22531 Texas U., Austin Computation Center
ON THE TRIDIAGONALIZATION OF A NON-HERMITIAN MATRIX USING SIMILARITY TRANSFORMATIONS Interim Technical Report No. 2
Hsuan-Heng Wang May 1964 125 p refs
(Contract DA-ARO(D)-31-124-G388; NSF-GP-217)
(AROD-3772.4; AD-440375)

Recently La Budde developed a new method for tridiagonalizing an arbitrary real matrix using a sequence of similarity transformations. This method is essentially a generalization of the Householder method for real symmetric matrices. A major portion of this report is devoted to a discussion of La Budde's method. Some practical difficulties associated with the general matrix eigenvalue problem are discussed. A detailed derivation of La Budde's algorithm is given; the formulas used are simpler than La Budde's but retain all the important features of his formulas. The numerical instability of La Budde's method is described. An a priori error analysis of the tridiagonalization, using floating-point arithmetic when the matrix in question is Hermitian, is given. Results of some numerical experiments in

which the La Budde algorithm is tested on some sample matrices are presented. All of the computations were done on a Control Data 1604 computer using floating-point arithmetic.
Author

N64-22540 California U., Los Angeles
MINIMAL VARIETIES AND KAHLER SUBMANIFOLDS
Technical Report No. 35
Alfred Gray (Ph.D. Thesis) Jun. 1964 69 p refs
(Grant DA-ARO(D)-31-124-G40; NSF G-1605)
(AROD-1517-62; AD-441222)

The purpose of this dissertation is to generalize the notion of minimal surface in R^3 to higher dimensions and to investigate its properties. By considering the second fundamental form of one Riemannian manifold immersed in another, an invariant called the mean curvature vector is obtained. The vanishing of this vector is the defining property of a minimal variety. For the case of a surface in R^3, this definition is equivalent to the sum of the principal curvatures being zero. Also, the relation between complex manifolds and minimal varieties was investigated. It was proven that every Kähler submanifold is minimal varietiety; thus, for example, the graph of an analytic function in R^4 is a Kähler submanifold and hence a minimal surface. In considering quaternionic Kähler submanifolds, the additional structure implies that they must be totally geodesic. An investigation of the global properties of minimal varieties shows that if $\overline{M}$ is a complete Riemannian manifold with nonpositive sectional curvature, then there are no compact minimal varieties; on the other hand, if $\overline{M}$ has a positive sectional curvature, then any compact minimal variety cannot be too small in relation to M. I.v.L.

N64-22548 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
ON STOCHASTIC PROCESSES AND THEIR REPRESENTATIONS
Crosman Jay Clark 24 Apr. 1964 50 p refs
(Contract DA-36-039-AMC-00088(E))
(EDL-M635; AD-601521)

This report is concerned with the statistical modeling of physical systems and with various mathematical formulations of the models. Instead of giving the complete set of output–input pairs that characterize a physical system, odds are given that any specific output from a set of possible outputs will occur. This is called a statistical model of the system. Another form of the statistical model is given the odds that at any specific time a certain value from a set of values will occur. This report examines both of these forms of statistical modeling. It sets up a general theory of stochastic processes that includes the theory of time series analysis and examines various mathematical representations of the general theory. Author

N64-22549 Columbia U., New York, N.Y.
SELECTED TOPICS IN MARKOV CHAIN THEORY, WITH AN APPLICATION TO MARKETING
George P. H. Styan (M.A. Thesis) 3 Apr. 1964 55 p refs
(Contract Nonr-266(33))
(CU-72-64-Nonr-266(33)MS; AD-601430)

Discrete time-parameter Markov chains with a finite state space are considered. After a dicussion on estimation of the parameters, various aspects of statistical inference relating to the order of the chain and the stationariness of the transition probabilities are presented. The theory of ergodic and absorbing chains is then developed using matrix algebra techniques. These allow most of the interesting criteria to be written in closed-form expressions. The paper concludes with an application to marketing based on data obtained from a consumer panel in England. These data are shown to fit fairly well to a first-order chain in equilibrium with stationary transition probabilities.
Author

N64-22599 Wisconsin U., Madison
SPECTRAL MEASURES, GENERALIZED RESOLVENTS, AND FUNCTIONS OF POSITIVE TYPE
Robert Mc Kelvey Apr. 1964 54 p refs
(Contract DA-11-022-ORD-2059)
(MRC-458; AD-600732)

The theme of this report is the interplay of classes of operator-valued functions $\{E_t, R_\lambda, V_s\}$ acting in a Hilbert space. In the prototype these functions are associated with a self-adjoint T: E_t is the spectral function of T, R_λ is its resolvent, and V_s is the unitary group e^{-isT}. In another case E_t is the generalized spectral function of a symmetric operator, and R_λ is its generalized resolvent. In still another case V_s is identified as a semigroup of contraction operators. Author

N64-22600 Wisconsin U., Madison
ON ESTIMATING LOCATION AND SCALE PARAMETERS FROM TRUNCATED SAMPLES
Lionel Weiss Mar. 1964 15 p refs
(Contract DA-11-022-ORD-2059)
(MRC-459; AD-600733)

Asymptotically efficient estimators are developed for the problem of estimating a location and a scale parameter, using only the observations between the p^{th} and q^{th} sample quantiles.
Author

N64-22601 Wisconsin U., Madison
CANONICAL REPRESENTATIONS OF CHAIN EVENTS
Michael Yoeli Mar. 1964 19 p refs
(Contract DA-11-022-ORD-2059)
(MRC-462; AD-600734)

So far studies of canonical representations for regular events were essentially restricted to definite events. In this paper two additional classes of events, namely normal and uniform chain events, are introduced for which unique canonical representations exist. Most of the algebraic properties of regular events required in this study are derived from a rather general system of postulates that also applies, e.g., to binary relations, Boolean matrices, and their generalizations. Author

N64-22602 Wisconsin U., Madison
DECOMPOSITION OF CONES IN MODULES OVER ORDERED RINGS
Michael N. Bleicher and Hans Schneider Apr. 1964 39 p refs
(Contract DA-11-022-ORD-2059)
(MRC-463; AD-600735)

A proper cone is prime if it has no nontrivial direct summand. If a cone has a prime decomposition, then it is unique. Under certain chain conditions finite prime decompositions exist. In a wide class of modules—the PF modules—every nontrivial summand of a cone lies in its boundary. Certain topological and ring theoretic notions arising from the above are studied in detail. Many clarifying examples and applications are given. In particular, some new results on Hermitian matrices are derived. Author

N64-22603 Wisconsin U., Madison
EFFICIENT USE OF NEWTON'S METHOD
Lydia R. Lohr and L. B. Rall Mar. 1964 11 p refs
(Contract DA-11-022-ORD-2059)
(MRC-464; AD-600736)

Theorems of L. V. Kantorovich are used to compare the overall efficiency of Newton's method and its modified form for the approximate solution of systems of equations. Criteria are given for choosing the method to achieve given accuracy in minimum time. This comparison and decision process may be incorporated directly into computer programs, and the basic analysis involved applies to any iterative process for which the convergence rate is known. Author

N64-22604 Wisconsin U., Madison
BLOCK RELAXATION BY COMPUTER
J. Barkley Rosser Apr. 1964 10 p
(Contract DA-11-022-ORD-2059)
(MRC-477; AD-600740)

To find the values ϕ_{ij} at grid points, for a grid of squares of side h, of the solution to a difference equation approximation to Laplace's equation in a region, being given values on the boundary is required. A block relaxation is defined for computer purposes. Given estimates of ϕ_{ij} on the boundary of a block, the solution of the difference equation inside the block for the given values of ϕ_{ij} on its boundary is determined, and takes these as the new estimates for the ϕ_{ij} at points inside the block. The blocks can be taken as squares of side 2Nh, and then the successive relaxations are uniquely determined if estimates for ϕ_{ij} are available only at points of a filagree consisting of the grid points on a network consisting of horizontal and vertical lines, separated by a distance of Nh. By restricting attention exclusively to filagree points until convergence is complete, the demands on computer memories are reduced by factors as great as 8. Problems of previously unmanageable size may now be dealt with. The method is easily extended to the solution of Poisson's equation. Author

N64-22613 RAND Corp., Santa Monica, Calif.
QUASILINEARIZATION, SYSTEM IDENTIFICATION, AND PREDICTION
R. Bellman, H. Kagiwada, and R. Kalaba Aug. 1963 22 p refs
(Contract AF 49(638)-700)
(RM-3812-PR; AD-414525)

This paper is devoted to a mathematical formulation and computational solution of the problems of system identification and the determination of unmeasurable state variables on the basis of observations of a process. These factors are important in the design of adaptive controllers. The approach suggested, based on the theory of quasilinearization, is an outgrowth of research on the computational solution of multipoint boundary-value problems. Author

N64-22614 RAND Corp., Santa Monica, Calif.
DYNAMIC PROGRAMMING: A BIBLIOGRAPHY OF THEORY AND APPLICATION
Richard Bellman and Rebecca Karush Feb. 1964 144 p refs
(Contract AF 49(638)-700)
(RM-3951-PR; AD-429915)

This bibliography of publications concerning the theory and application of dynamic programing covers all phases of problem solving, including recognition, formulation, analysis, computation, and reformulation. The bibliography is divided into three parts—first, a chronological ordering of publications, with authors listed alphabetically under each year; second, an alphabetical index of authors; and third, a subject index, with authors listed alphabetically under each subject category. R.T.K.

N64-22615 RAND Corp., Santa Monica, Calif.
A MULTISTAGE STOCHASTIC INVESTMENT PROCESS
A. J. Truelove Mar. 1964 35 p ref
(Contract AF 49(638)-700)
(RM-4025-PR; AD-432296)

This is a piece of basic research in probability theory, and is expressed conventionally in gambling terms. The problem of finding betting policies that ensure the maximum probability of surviving infinitely, under a fixed cost-of-living charge, and a known fixed payoff is described. The work may be extended later to more general cases. Author

N64-22619 RAND Corp., Santa Monica, Calif.
ON THE BEHAVIOR OF A CHEMICAL EQUILIBRIUM SYSTEM WHEN ITS FREE ENERGY PARAMETERS ARE CHANGED
N. Z. Shapiro May 1964 12 p ref
(Contract AF 49(638)-700; Proj. RAND)
(RM-4128-Pr. AD-600884)

An inequality furnishing information about the behavior of a chemical equilibrium system when its free energy parameters are changed is presented. The result is proved by viewing the solution of a chemical equilibrium problem as the result of minimizing the free energy function. Were the solution viewed in terms of the mass action laws, the proof would become much more difficult. Author

N64-22623 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CERTAIN PROBLEMS OF THE THEORY OF STATISTICAL LINEARIZATION AND ITS APPLICATION
I. Ye. Kazakov 27 Feb. 1963 29 p refs Transl. into ENGLISH from Statis. Metody Issld., Tr. i Mezhdunar. Kongressa Mezhdunar. Federatsii Po Avtomat. Upr. Moscow, Izd. AN SSR, 1961 p 68–83
(FTD-TT-62-1385/1+2+4; AD-401589)

Examined are the general aspects of the theory of statistical linearization based on the approximation of an arbitrary nonlinear transformation of a random function by an equivalent linear operator. Applications of this theory to an analysis of the accuracy of nonlinear automatic control systems are given. Practical methods of determining the equivalent operator for a nonlinear transformation of random functions are recommended. Author

N64-22699 ARO, Inc., Arnold Air Force Station, Tenn.
A UNIVERSAL DATA PROCESSING SYSTEM FOR THE MARK I AEROSPACE SYSTEMS ENVIRONMENTAL CHAMBER
Ralph E. Klautsch and James W. Shenk (Consolidated Systems Corp.) Arnold Eng. Develop. Center, Jun. 1964 38 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-123; AD-441189)

Discussed is a data processing system, designed specifically to accommodate the vehicle instrumentation test requirements of a large environmental space simulation chamber. Prominent features of the system include a versatile input section capable of accepting FM/FM, PCM, and PAM/PDM telemetry signals and analog information; a stored program analog sequencer and telemetry decommutator; a data compressor; and an on-line computer. Primary emphasis in system design has been placed on flexibility and versatility. Reasons for this emphasis are presented with views on system utilization. Author

N64-22706 Naval Ordnance Lab., White Oak, Md.
A PROCEDURES MANUAL FOR COMPUTING PROPELLANT THERMODYNAMIC PROPERTIES
Bernard A. Burke May 1964 102 p
(NOLTR-63-202; AD-600988)

This manual describes the procedures used to compute propellant thermodynamic properties. A typical specific impulse problem is solved, followed by the procedure used to add thermodynamic data to the calculation system, and a discussion of various difficulties that might be met. An appendix contains the FORTRAN listing of the specific impulse program. The operating system used with the IBM-7090 is described wherever applicable to the work, and each kind of program output sheet is illustrated. Author

21 METEOROLOGY

Includes climatology; weather forecasting; and lower atmosphere studies. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N64-21623 Navy Weather Research Facility, Norfolk, Va.
ATMOSPHERIC ELECTRICITY MEASUREMENTS AS A POSSIBLE AID IN FOG FORECASTING
G. D. Hamilton Dec. 1963 31 p refs
(NWRF-29-1263-086; AD-431763)

This report evaluates previously derived rules for the short-range forecasting of fog, using as a tool continuously recorded atmospheric electric potential and electric field measurements. Although some correlation exists between atmospheric electricity variables and fog, the accuracy and dependability of the technique were not high enough to be rated a useful fog forecasting technique. Considering the knowledge in atmospheric electricity, it is doubtful whether any changes in the fog forecasting rules could significantly improve the method. Also discussed in the report are some unsuccessful attempts correlating atmospheric electricity measurements with other meteorological parameters. Author

N64-21712 Technical Operations Research, Burlington, Mass.
INVESTIGATION OF OPTIMAL DESIGN FOR SUPERCOOLED CLOUD DISPERSAL EQUIPMENT AND TECHNIQUES Final Report, Dec. 1962–Mar. 1963
William W. Vickers and Richard Profio Feb. 1964 113 p refs
(Contract AF 19(628)-1692)
(TO-B-64-32; AFCRL-64-427; AD-601173)

To determine optimal cloud-seeding techniques and optimal design specifications for a dry-ice seeding machine (the Cloudbuster), multiple strip seeding of stratiform decks was performed during which seeding rate, pellet size, and strip orientation with respect to wind were systematically changed from strip to strip. Concurrently, the physical properties of the cloud decks were measured, and cloud response to the varying treatments was measured photogrammetrically; both the dry-ice seeding rate and pellet size, as well as the cloud temperature, exerted a strong influence on cloud response. Seeding rate had an optimum of 8 to 9 lb/nmi of CO_2 pellets whereafter additional quantities no longer influenced the experiment predictably. Generally, clouds failed to respond to treatment at 1.8 lb/nmi. Strips should be seeded about 40 min worth of drift upwind of the desired location, and should be seeded across the wind. Seeding altitude for the aircraft should be coincident with the top of the deck for all but thickest decks (> 1,200 ft). For thick decks, penetration into the top 1/2 to 1/3 of the cloud decks is recommended as well as enlargement of seeded zone by a second seeding along the perimeter of the expanding ice crystal zone. Author

N64-21744 Chicago U., Ill.
A NUMERICAL COMPUTATION OF THE STORM SURGE OF HURRICANE CARLA 1961 IN THE GULF OF MEXICO
Masamori Miyazaki Nov. 1963 68 p refs
(Grant WBG-18)
(TR-10; AD-431652)

The storm surge of hurricane Carla 1961 in the Gulf of Mexico is computed by numerical integration of the dynamic equations. Input data consist of sea-level distributions of observed wind and pressure at 6-hour intervals throughout the 3 day period selected for the study. The computation is carried out in two steps. The first is on a rough mesh (mesh length 48 nmi) for the entire Gulf; bottom friction is disregarded in this step. The second is a fine-mesh computation (mesh length 9.6 nmi) on the northwestern continental shelf, where the storm surge was most prominent. Quadratic bottom friction is assumed in the latter step. The fine-mesh region is chosen so as to give good resolution in the neighborhood of Galveston, Texas. Computed variations of sea level are in good agreement with tide-gage observations in this region. Author

N64-21777 Defence Research Board, Ottawa (Canada) Defence Research Chemical Labs.
SOME SHORT-RANGE NARROW-BEAM ATMOSPHERIC TRANSMISSION MEASUREMENTS IN THE NEAR INFRARED
G. E. Berlinguette and P. A. Tate Dec. 1963 24 p refs
(Rept.-420; AD-434456)

Horizontal atmospheric transmission was measured for the wavelength region 0.9μ to 5.9μ with path lengths of 7 m, 10 m, 0.27 km, 0.67 km, and 1.1 km. Water vapor contents of the paths varied from 0.02 to 7.4 mm of precipitable water. An absolute transmission calibration was provided for the two longest path lengths by an infrared telephotometer. The accuracy obtained with this device was not sufficient to study the variation of nonselective transmission with wavelength. Selective window transmissions were calculated, and they agree generally with the results of other workers extrapolated to low-water contents. An exception is in atmospheric window VI, where the transmissions are significantly lower than the results of other workers would indicate. Author

N64-21822 Air Force Cambridge Research Labs., Bedford, Mass.
ACCURACY OF METEOROLOGICAL DATA OBTAINED BY TRACKING THE ROBIN WITH MPS-19 RADAR
Robert W. Lenhard, Jr. and Margaret P. Doody Dec. 1963 21 p refs *Its* Instrumentation for Geophys. and Astrophys. no. 35
(AFCRL-63-938; AD-434379)

A sample of 32 ARCAS-Robin rocket soundings that were tracked simultaneously by FPS-16 and MPS-19 radars was examined to determine the accuracy of meteorological data obtained from the less accurate radar, the MPS-19. The root-mean-square error in winds determined by the MPS-19 increased with altitude in a reciprocal relationship from 5 mps at 30 km to 45 mps at 70 km; it was less than 10 mps at all levels below 55 km. No evaluation of the accuracy of thermodynamic data was possible. Any such data obtained from an MPS-19 track will be rejected under the criteria of the existing data reduction program as being from a target that failed to inflate. Author

N64-21874 Deutscher Wetterdienst, Offenbach Am Main (W. Germany)
PROJECT CELL STRUCTURE OF THE ATMOSPHERE. DELIBERATIONS ON ENERGY ASPECTS OF LARGE-SCALE CIRCULATIONS

Heinrich Faust Nov. 1963 18 p refs
(Contract DA-91-591-EUC-2847)
(SR-1; AD-433768)

Deliberations on energy aspects show that the definition of a direct or indirect circulation according to the density field is more to the point than a circulation defined according to the temperature field. Some examples are given. The super-gradient winds in the null layer prove to be the transformation of the potential energy existent in a developing depression (horizontal-unstable mass distribution) into kinetic energy, the higher potential energy of an anticyclone of maximum distinctness as a consequence of the null-layer effect. The deliberations agree with conclusions that can be drawn from the Hollmann effect. Author

N64-22038 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
METEOROLOGY AND THE PILOT
I. V. Kravchenko 5 Dec. 1963 397 p Transl. into ENGLISH of "Letchiku o Meteorologii" Moscow, Voyennoye Izd. Min. Oborony SSSR, 1962 p 1–313
(FTD-TT-63-620/1+2; AD-432054)

The influence of meteorological elements on range, altitude, and flight safety at great altitudes is examined. Particular attention is given the effect on flight by pressure, density, and temperature. A description is presented of the jet streams and of the flight conditions in these streams in the U.S.S.R. Flight safety during thunderstorms and under icing conditions is discussed. Aircraft weather-reconnaissance procedures and the evaluation of meteorological conditions prior to and during flight are discussed. The basic principles of weather forecasting for the route and for the airfield are presented. R.T.K.

N64-22360 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
WHAT WILL THE WEATHER BE LIKE TOMORROW, COMRADE OUTER SPACE?
V. A. Bugayev 18 Nov. 1963 4 p Transl. into ENGLISH from Sov. Litva (USSR), no. 234, 4 Oct. 1962 p 2
(FTD-TT-63-967/1; AD-426380)

Many satellites equipped with weather forecasting instruments are needed for surface weather observations of the entire earth. Numerous weather satellites, simultaneously measuring and relaying weather information, will make it possible to predict all short-time weather changes. N.E.A.

N64-22381 Atmospheric Research and Development Corp., Kansas, Mo.
TROPOPAUSE PENETRATIONS BY CUMULONIMBUS CLOUDS Scientific Report No. 1
Howard H. Banks, Jr., Michael J. Long, and R. G. Beebe Feb. 1964 57 p refs
(Contract AF 19(628)-2454)
(AFCRL-64-111; AD-600819)

This report presents a 2 1/2-year climatology of penetrations of the tropopause at 9 stations in the United States. The WSR-57 radar data for 1961–1963 are summarized by geographical area, by months, and on a diurnal basis. The main summary is for penetrations greater than 5,000 and 10,000 ft. Conclusions are that penetrations of the tropopause occur near the time of maximum thunderstorm activity, mostly in the summer, and in the areas of greatest severe thunderstorm activity. There was no simple relationship found between tropopause penetrations and the number of thunderstorms; and there was no useful relationship found between tropopause height and the extent of the tropopause penetrations. Author

N64-22517 C-E-I-R, Inc., Boston, Mass.
CLIMATIC FREQUENCIES FOR LOW LATITUDE STATIONS Final Report
James Misho Jan. 1964 36 p
(Contract DA-19-129-QM-97(OI6064))
(AD-60031)

Tables and figures are presented that depict the temperature and humidity regimes in the zone between 35° N and 35° S. This area is composed of the tropics and the equatorward portion of the temperate regions of middle latitudes. Described are selection of basic climatic data, tropical climates, the wind regime, a definition of hot–humid and hot–dry regions, a definition of comfort index, influences of topography, and suggested methods of simulating frequency distributions. R.T.K.

N64-22550 Indiana U. Foundation, Bloomington Research Div.
VISIBILITY CONDITIONS IN MALAYA Final Report
Don C. Bennett and Richard D. Smith 25 Mar. 1963 122 p refs
(Contract DA-19-129-QM-1582)
(AD-439510)

This report examines visibility conditions in Malaya, and includes an analysis of visibility frequency for distance categories by month and day. A regional pattern is established. Factors inhibiting visibility in Malaya are examined. Author

N64-22618 RAND Corp., Santa Monica, Calif.
WEATHER INFORMATION: ITS USES, ACTUAL AND POTENTIAL
R. R. Rapp and R. E. Huschke May 1964 133 p refs
(Contract Cwb-10772)
(RM-4083-USWB; AD-600128)

This report is devoted largely to a discussion of the benefit to be derived from improved weather information. Included are discussions of the following: weather information and decisions; weather-service consumers and their requirements, planning research for improved information, feasibility of cost-benefit studies, compiling a weather-problem catalog, résumé of the analysis of one of the weather problems of the raisin industry, and the value of aviation-route wind forecasts. R.T.K.

N64-22637 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OPTICAL DETERMINATION OF THE CONCENTRATION OF WATER DROPS IN THE ATMOSPHERE DEPENDING ON THE RADIUS
G. P. Gushchin 25 Feb. 1963 19 p refs Transl. into ENGLISH from the Book "Aktinometriya i Atmosfernaya Optika" Leningrad, Gidrometeoizdat, 1961 p 218–227
(FTD-TT-62-1803/1+2+4; AD-401732)

Starting from Mie's law and using the numerical values of the scattering function for water, the author gives a system of linear equations determining for n wavelengths the extinction caused by a mixture of droplets with n different radii. After solving the system of equations we obtained all n of the concentration corresponding to n radii. In spite of the fact that the system of equations is given for droplets of pure water, it can be used with sufficient accuracy for droplets with a refractive index up to 1.4. Author

N64-22651 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THEORY OF THE PHENOMENA OF ATMOSPHERIC ELECTRICITY

Ya. I. Frenkel' 12 Nov. 1963 172 p refs Transl. into ENGLISH from the book "Teoriya Yavleniy Atmosfernogo Elektrichestva" Leningrad, Gosudarstvennoye Izdatel'stvo Tekhniko-Teor. Lit., 1949 p 1–155
(FTD-TT-63-595/1+2; AD-429450)

The following subjects are discussed with respect to the phenomena of atmospheric electricity: (1) origin and properties of the atmospheric electric field; (2) microseparation of electric charges in the atmosphere; (3) formation and electrification of atmospheric precipitation; (4) phenomena preceding thunderstorms; (5) thunderstorm phenomena; and (6) variations in the atmospheric electric field. P.V.E.

N64-22687 Oklahoma U. Research Inst., Norman Atmospheric Research Lab.
PROGRESS ON A STUDY OF ATMOSPHERIC CIRCULATION TO 200 KILOMETERS IN TERMS OF DENSITY Scientific Report No. 3
V. S. Whitehead and W. J. Saucier Feb. 1964 50 p refs
(Contract AF 19(628)-489)
(ARL-1357-3; AFCRL-64-256; AD-601226)

This report presents a summary of the results to date of a study of circulation to 200-km altitude in terms of density. Equations are developed that describe the behavior of density in hydrostatic atmospheres in general. The effect of vertical motion on the density departure from standard is shown for three hypothetical atmospheres. A method is developed for determination of the slopes of constant density surfaces from the wind field. The results of applying this method to the wind data taken from the Meteorological Rocket Network are given. A simple two-dimensional model for the atmosphere between 90 and 220 km is constructed. This model is based on assumed equilibrium between absorption of solar electromagnetic radiation and downward conduction of thermal energy. Author

N64-22695 Technical Operations Research, Burlington, Mass.
PROTOTYPE DEVELOPMENT FOR METEOROLOGICAL INSTRUMENTS Final Report
Calvin Y. Sing, Brian J. Thompson, and Anthony F. Souza 13 Jan. 1964 83 p refs
(Contract AF 19(604)-6661)
(AFCRL-64-92; AD-600836)

Three types of instruments have been designed, fabricated, and tested for measuring various meteorological parameters: (1) A raindrop spectrometer using the principle of right-angle scattering of light is capable of resolving raindrops 0.2-mm to 5-mm diameter to within a precision of ±10% while maintaining a counting rate of at least 100 drops per second. It has been designed to fit within the envelope of an external wing tank for the C-130-type aircraft. (2) A liquid-water-content meter that uses a capillary collector head for collecting the water was completely automated for unattended operation in the field. (3) A droplet disdrometer utilizing the coherent light available from an optical maser (laser) to illuminate the water droplets in fog was developed to determine the size and distribution of these particles. The light illuminating these droplets was diffracted into rings, which were photographed. The size and distribution of the droplets were then determined from these ring patterns on the film. Author

22 NAVIGATION AND GUIDANCE

Includes autopilots; star tracking; inertial platforms; and air traffic control. *For related information see*: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities, Research and Support; 15 Instrumentation and Photography; 20 Mathematics; and 29 Space Sciences.

N64-21621 Space Technology Labs., Inc., Redondo Beach, Calif.
THREE-DIMENSIONAL PROBABLE ERROR
S. R. Coombs 27 Jan. 1964 10 p refs
(GM-00-6437-00161)

Formulas for the three-dimensional analog of CEP (circular probable error) are developed. The case considered is the radius of a sphere centered about a target within which there is 50% probability of impact in the generalized sense of the term. The miss components are assumed to be normal variables with zero means. R.T.K.

N64-21931 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INERTIAL NAVIGATION
I. A. Gorenshteyn, I. A. Schul'man, and A. S. Safaryan 13 Jan. 1964 258 p refs Transl. into ENGLISH from the Book "Analiz i Raschet Usilitel'nykh Skhem" Kiev, Gos. Izd. Techn. Lit., 1963 p 1–244
FTD-TT-63-474/1+2; AD-432079)

This book covers the following: (1) theoretical basis of inertial navigation (with an error analysis); (2) methods of designing inertial navigation systems; (3) methods of readying inertial navigation systems for operation; (4) methods of correcting these systems; (5) elements of inertial navigation systems—accelerometers, gyros, computing devices, and other components of the systems. P.V.E.

N64-22104* Westinghouse Electric Corp., Baltimore, Md.
REQUIREMENTS FOR ONBOARD OPTICAL GUIDANCE OF SPACECRAFT ON LUNAR TRAJECTORIES
Edgar J. Bowers, Jr. [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(Contract NASw-460)
(AIAA Paper-64-234) AIAA: $0.50 members, $1.00 nonmembers

A study made to define sensor requirements for the midcourse guidance phase of lunar missions is summarized. A general formulation of the problems involved is presented, and guidance-system parameter variations are detailed. In addition, guidance scheduling problems are discussed, and the principles of measurement selection are explained. P.V.E.

N64-22131 White Sands Missile Range, N. Mex. Inter-Range Missile Flight Safety Group
STANDARDIZED TEST PROCEDURES UHF FLIGHT TERMINATION RECEIVERS
Apr. 1964 34 p
(IRMFSG-303-64; AD-434900)

Standardized interrange test procedures for UHF flight-termination receivers are presented. All tests are concerned only with the range-safety type of missileborne receivers. Discussion of the following are included: standard input parameter tolerance, requirements and characteristics of test equipment, nominal test conditions, general and specific test procedures, receiver operational tests, interference and environmental tests, and test-equipment list. R.T.K.

N64-22157 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
AUTOMATIC HOMING AND COMBINED ROCKET GUIDANCE SYSTEMS
D. St. Andreescu 8 May 1964 7 p Transl. into ENGLISH from Viata Militara (Rumanian), v. 16, no. 3, 1963 p 31
(FTD-TT-64-84/1+2+3+4; AD-600488)

A brief discussion is presented of a few problems concerning the automatic guidance of rockets, as well as the use of combined (automatic and remote) guidance systems. P.V.E.

N64-22356 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

GYROSCOPIC EFFECT, ITS PHENOMENA AND APPLICATION (SELECTED CHAPTERS)

V. A. Pavlov 29 Jan. 1964 81 p refs Transl. into ENGLISH from the Book "Giroskopicheskiy Effekt, Ego Proyavleniya i Ispol'zovaniye" Leningrad Sudpromgiz, 1961 p 52–75, 118–147

(FTD-TT-63-837/1+2+4; AD-600041)

The following areas of gyroscope phenomena and application are discussed: (1) the gyroscope in the navy—the necessity of using the gyrocompass in navigation, the Foucault gyrocompass, a practical model of a gyrocompass, instruments that operate from the gyrocompass, a gyroscopic steering instrument, gyroscopic indicator of geographic latitude, gyroscopic ship's stabilizers, and a ship's stabilizer with a control gyroscope; (2) the gyroscope in mining—the need for instruments to provide rapid investigation of natural resources, gyroscopic inclinometer, gyroscopic stabilizer for a magnetometer, and a mine-surveyor's gyrocompass; and (3) the gyroscope for military purposes—increasing the range and accuracy of firing, an artillery-shell gyroscope, gyroscopic stabilizers of artillery weapons, gyroscopic stabilizer for a tank cannon, tank gyrocompass, gyroscopic stabilizer for a naval torpedo, gyroscopic instruments controlling the flight of a winged missile, and gyroscopic instruments controlling the flight of a ballistic rocket. P.V.E.

N64-22473* Minneapolis-Honeywell Regulator Co., St. Petersburg, Fla. Military Products Group

A STUDY FOR AN ACCURACY DETERMINATION PROGRAM FOR THE PSEUDO-DIURNAL TRANSIT TECHNIQUE OF SPACE NAVIGATION ("PDT STUDY"), PHASE I Final Report

17 Nov. 1963 283 p refs

(Contract NAS1-2858)

(NASA-CR-56288; MH-HAR-2858-FR) OTS: $18.00 ph

The PDT technique provides a means for establishing vehicle lines-of-position from near bodies by angular measurements derived from planet and star transits across a pair of reference "great circle" markers that are optically swept across the celestial sphere by the rotation of the mechanism about a single, known axis in inertial space (the pseudodiurnal axis). Direct measurements of declinations are avoided. A high-precision, electro-optical transit detector is capable of resolving 0.168 arc second. The difficulties associated with scale readings are eliminated by application of a digital, dynamic goniometer (dynagon) with a 12-in.-diam rotor to the PDT axis, about which all angles are read; this device has a basic resolution of $\pm 0.15^{+}$ arc second. The pseudodiurnal motion at constant rate, originally postulated, has been replaced by the central rotor motion of the dynagon, whose rate need be constant only during resolution between adjacent 1/8192th (of a circle) markers. Author

N64-22485 Royal Aircraft Establishment, Farnborough (Gt. Brit.)

TABLE OF THE ARTIFICIAL EARTH SATELLITES LAUNCHED IN 1957–63

D. G. King-Hele and Eileen Quinn London, Min. of Aviation, Feb. 1964 55 p refs

(RAE-TN-SPACE-56)

A table is given of all known artificial satellites launched before January 1, 1964, with lifetimes, weights, dimensions, and details of the orbits, whenever known, for all instrumented satellites and their final-stage rockets. Other fragments from the satellites are listed without these details. The methods used in compiling the table and the difficulties encountered are outlined. A table of radio transmission frequencies is also given. Author

N64-22641 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

NEW GYROSCOPIC DEVELOPMENTS

A. Kaczmarczyk 25 Feb. 1963 30 p refs Transl. into ENGLISH from Wojskowy Przeglad Lotniczy (Warsaw), v. 16, no. 1, 1962 p 28–42

(FTD-TT-62-1878/1+2; AD-401733)

The following types of gyroscopes are discussed: (1) floated gyroscopes; (2) differentiating floated gyroscopes; (3) integrating floated gyroscopes; (4) floated gyroscopes with three degrees of freedom; (5) vibrating rate gyroscopes; and (6) particle gyros (corpuscular). Also discussed are the production of floated gyroscopes, gyroscopes in a magnetic suspension, and gas-bearing floated gyroscopes together with the use of ceramic materials in their construction. P.V.E.

23 PHYSICS, GENERAL

Includes acoustics; cryogenics; and optics. *For astrophysics see*: 05 Astronomy and Astrophysics. *For related information see*: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 25 Physics, Solid-State.

N64-21502 Lessells and Associates, Inc., Waltham, Mass.

ACOUSTIC EMISSION UNDER APPLIED STRESS Technical Documentary Report, 15 Apr. 1963–15 Apr. 1964

B. H. Schofield Wright-Patterson AFB, Ohio, AF Materials Lab., 1964 36 p refs

(Contract AF 33(657)-8562)

(ASD-TDR-63-509; PT II AD-600233)

These studies were made to assess the role of the surface and surface films in the generation of acoustic pulses, i.e., acoustic emission of metals. Experiments were conducted on single crystals of pure gold of varying crystallographic orientation. Specific crystallographic orientations were chosen to evaluate the effect of screw and edge dislocation mobility separately. Specimens were deformed in tension in ambient atmosphere. Results indicated that the surface and its condition played a minor role in the generation of the acoustic pulses, the phenomenon being related to the volumetric condition. Specific observations suggest the development of structural faults during deformation, reminiscent of elemental twins. Emission characteristics peculiar to gold are discussed for the several experiments. Author

N64-21505 Naval Radiological Defense Lab., San Francisco, Calif.

MEASUREMENTS OF THE EFFECTS OF COMPARTMENTALIZATION ON THE GAMMA-RAY AND NEUTRON DOSE RATE IN THE RADIATION FIELD OF A REACTOR

W. E. Thompson and F. C. Engesser 17 Feb. 1964 53 p refs (Sponsored by DASA)

(USNRDL-TR-722; AD-437994)

Data illustrating the effects of various components of a simply compartmented structure on the dose-rate field near a reactor are presented in forms allowing convenient comparisons between gamma-ray and neutron dose rates for given configurations. These effects were found to be nearly equivalent

to the additive effects of the sides of the compartment considered separately, thus adding credence to the assumption that each slab contributes to the total dose rate independently. By weighting these contributions according to solid angle, a method is worked out that consistently predicts the dose rate for any configurations not involving double transmission. Author

N64-21510 Oak Ridge National Lab., Tenn.
MEASUREMENTS OF RADIATION INTENSITIES IN VERTICAL CONCRETE-LINED HOLES AND AN ADJOINING TUNNEL AT THE TOWER SHIELDING FACILITY
V. R. Cain, C. E. Clifford, and L. B. Holland Mar. 1964 88 p refs
(Contracts W-7405-ENG-26; AF-04(694)-62-2; OCD-OS-62-145)
(ORNL-3513; ORNL-TM-285) OTS: $2.00

Fast-neutron and gamma-ray dose rates within 4-ft-diam, 20-ft-deep, concrete-lined holes were measured. The radiation source was the Tower Shielding Reactor II (TSR-II) enclosed in a shield, which modified the neutron-to-gamma-ray ratio of the reactor leakage spectrum to more closely resemble that of a weapon spectrum. The holes were located at horizontal distances of 100, 228, and 450 ft from the reactor. From the hole at 100 ft extended a reinforced concrete-lined tunnel, 6-ft high, 2 1/2-ft wide, and 20-ft long, with its ceiling 10 ft below ground level. The experimental measurements consisted of vertical traverses in the three holes and horizontal traverses in the tunnel. The parameters varied included distance from the reactor, the angle-of-elevation of the reactor with respect to the horizontal at the hole, and the material and thickness of the shield over the hole. Reactor elevation angles ranged from 15° to 90°. The shields over the holes were concrete, iron, and laminated iron and concrete slabs. Author

N64-21512 National Bureau of Standards, Washington, D.C.
1963 RESEARCH HIGHLIGHTS OF THE NATIONAL BUREAU OF STANDARDS Annual Report, Fiscal Year 1963
Dec. 1963 257 p refs
(NBS Misc. Publ.-255) GPO: $1.00

The technical program of the National Bureau of Standards (NBS) is primarily concerned with research in the general field of physical measurements, which includes basic measurement standards, standard reference data, and standard reference materials. In addition, NBS has operated research programs in mission-oriented fields such as radio propagation, data-processing systems, and building materials and structure. Consulting services to Federal, State, and municipal governments, and sponsored research by commercial and industrial organizations further enlarge the scope of NBS programs. Brief descriptions of the research programs are given and categorized into the following areas: meteorology, mechanics, electricity, radio standards, heat, atomic physics, radiation physics, laboratory astrophysics, analytical and inorganic chemistry, physical chemistry, inorganic solids, metallurgy, polymers, applied mathematics, radio propagation, cryogenic engineering, and building research. D.S.G.

N64-21517 Dewey (G. C.) Corp., New York, N.Y.
CALCULATION OF DIPOLE MATRIX ELEMENTS Final Report
S. Borowitz and M. Vassell Kirtland AFB, N. Mex., Res. and Technol. Div., Feb. 1964 53 p refs
(Contract AF 29(601)-5342)
(RTD-TDR-63-3111; AD-432703)

Dipole matrix elements for 7s–np transitions in cesium have been calculated using model wave functions of an electron moving in a Thomas–Fermi ion core. The calculated values for the energy levels using this model are in error by approximately 9% for the 7s state and are somewhat greater for the p states. The dipole matrix elements calculated for this model are in error by about a factor of 3. A variational principle has been derived for off-diagonal matrix elements of any operator. This principle provides no correction for this model and for the Hartree model, but has application if simple trial wave functions are used. Author

N64-21518 National Co., Inc., Malden, Mass.
CESIUM BEAM TUBE STUDIES First Quarterly Progress Report, 1 Jul.–1 Oct. 1963
J. George, T. Athanis, and P. Crandell [1963] 55 p refs
(Contract DA-36-039-AMC-02367(E))
(Rept.-1; AD-432928)

Cesium beam optics efficiency, C-field homogeneity, and microwave fields and phase were investigated. The results of the analysis are presented, and the design of the experiments on cesium beam effusion patterns, C-field homogeneity, magnetic shielding, microwave-field homogeneity, and cavity phase was initiated. The results of the analysis in many cases were substantiated through experiments in the other current programs. Author

N64-21535 IIT Research Inst., Chicago, Ill.
X-RAY K ABSORPTION SPECTRA OF Ni-Al ALLOYS
Badri N. Das and Leonid V. Azaroff Feb. 1964 21 p refs
(Contract Nonr-1406(07)/NRO-31-684)
(TR-64-1; AD-433155)

The Ni K absorption spectra in five nickel-rich solid solutions and the intermediate phases Ni_3Al, NiAl, and $NiAl_3$ are presented. By considering the absorption process taking place within the nickel atoms, variations in the fine structure of the absorption spectra are interpreted in terms of the possible electronic structures of nickel atoms. The electronic structure changes markedly with composition in the α solid solution in a way suggestive of covalent bond formation. This effect becomes even more pronounced in the ordered α' phase (Ni_3Al). The spectra of NiAl and $NiAl_3$ are somewhat more difficult to interpret because of changes in the crystal structure, but it appears that covalency is also present in NiAl whereas electron transfer is more likely in $NiAl_3$. The presence of the so-called K-state is detected in solid solutions containing less than 4 at. % Al and it appears to be structurally related to the α' phase. Author

N64-21543 University Coll. of North Staffordshire, Keele (Gt. Brit.)
RESEARCH IN MOLECULAR QUANTUM THEORY Final Technical Report, 1 Nov. 1962–31 Oct. 1963
30 Nov. 1963 30 p refs
(Contract DA-91-591-EUC-2736)
(AD-431985)

Work carried out in developing a theory in which correlation between all pairs of electrons is introduced as a refinement of the basic Hartree–Fock approximation is discussed. The work is divided into two main areas: (1) The determination is made of a best one-determinate function, in general of "open-shell" form, having constraints applied so that some of the orbitals (those of the "closed-shell") remain doubly occupied. (2) Functions are developed in which a pair of electrons, as excited from the Hartree–Fock state, are allowed to mix with the latter under the effect of a perturbation–which is the difference between

the actual and Hartree–Fock interaction potentials. Also presented are abstracts of recently published papers and detailed accounts of work still in progress. Subjects discussed in this section are: (1) open-shell and closed-shell self-consistent field theory; (2) the theory of pair-correlated wave functions; and (3) the theoretical basis of the spin hamiltonian. P.V.E.

N64-21561 Massachusetts Inst. of Tech., Cambridge Fluid Mechanics Lab.
THE KINETIC EQUATION OF CLASSICAL BOLTZMANN GASES
C. H. Su Mar. 1964 30 p refs
(Contract Nonr-1841(93))
(Publ. No. 64-2; AD-434730)

Using the multiple-time-scale method, the low density expansion is carried to the order of the triple collision integral. The validity of Bogoliubov's assumption that the multiple distribution depends functionally on a single particle distribution is carefully examined; such an assumption is valid except locally for those particles having a large separation at a time t and having their relative velocity so oriented that they were in collision at t = 0. Since this local breakdown is very selective, the triple collision integral found in the literature is still correct. As a by-product of the multiple-time-scale method, the rate at which a system approaches the kinetic state is obtained; up to the order considered, the Maxwellian distribution is the only solution at thermal equilibrium. Author

N64-21565 Emory U., Atlanta, Ga.
MICROWAVE INVESTIGATION OF MOLECULAR STRUCTURE AND PROPERTIES Final Report, 1 Sep. 1960–31 Aug. 1963
James W. Simmons and J. H. Goldstein [1963] 10 p
(Grants DA-ORD-24; DA-ARO-(D)-31-124-6336)
(AD-438043)

The current program status is as follows: (1) The molecular orbital calculations for dichloroethylene have been completed. (2) An analysis of microwave data obtained for chloroallene and for bromoallene has not yet made possible a final determination of their molecular structures. (3) Calculations on an extensive series of halomethanes were successful in accounting for the effect of substituents on $C^{13}H$ coupling constants in nuclear magnetic resonance spectra. (4) Assignments have been made for the Cl^{35} rotational spectrum of $C_2H_2Cl^{35}CN$ based on R-branch a-type and Q-branch b-type transitions. The quadrupole coupling constants and effective moments of inertia have been determined tentatively. The moments of inertia verify that the molecule is planar. (5) Investigations of centrifugal distortion effects have been completed on a series of CD_3Cl, CD_3Br, and CD_3I, including measurements of the J = 0 to 1 transitions and of several higher J transitions (up to J = 8 to 9) in the 150-Gc frequency region. (6) Modifications have been carried out on the K-band microwave spectroscope to extend its frequency coverage to 40 Gc. Also, a list of reports submitted or in preparation is presented. I.v.L.

N64-21576 Bureau of Mines, Pittsburgh, Pa.
HYPERVELOCITY IMPACT PHENOMENA Quarterly Report, 1 Dec. 1963–29 Feb. 1964
Richard W. Watson, Karl R. Becker, and Frank C. Gibson 16 Apr. 1964 25 p refs
(ARPA Order 149)
(AD-439301)

Research was devoted to developing techniques to study the transmission characteristics of shock waves generated by the impact of hypervelocity projectiles on both metallic and nonmetallic targets. Photographic methods such as streak and framing camera techniques were used in experiments to investigate the shock pressure field generated by the impact of aluminum projectiles on Lucite targets. An electronic technique based on an expendable resistive pressure transducer was applied to impact studies on explosive loaded target materials such as polyethylene sheet, Nylon and glass fiber laminated phenolic materials. Deficiencies in the 9.3 km/sec inhibited jet projector system were revealed during this investigation; the sources and methods of overcoming them are discussed. D.S.G.

N64-21578 Boston U., Mass.
STUDIES IN STATISTICAL OPTICS Final Report
E. L. O'Neill, J. B. De Velis, and A. S. Marathay 31 Jan. 1964 11 p refs
(Contract DA-ARO(D)-31-124-G-260)
(AROD-315-76; AD-438044)

Using the concept of entropy density, a method was devised for calculating the gain in information as a measure of two levels of ignorance: before and after the measurement. The information gained from a measurement can be represented in terms of the logarithm of the ratio of the probability distributions. A number of simple tests were constructed to correct errors in nonlinear phase shifts by plotting the phase in an unambiguous way. It must be recognized that image quality is determined by the wavefront taken as a whole and not by individual aberrations considered singly. All terms must enter into the averaging procedure to determine optimum balancing conditions. The possibility of approaching the whole theory of partial polarization as an eigenvalue is discussed. A.W.

N64-21579 General Mills, Inc., Minneapolis, Minn. Electronics Div.
FUNDAMENTAL STUDIES OF THE DISPERSABILITY OF POWDERED MATERIALS Final Report, 3 Jun. 1960–31 Jan. 1963
J. H. Nash, G. G. Leiter, A. P. Johnson, D. Stender, and H. W. Zeller 15 Mar. 1963 250 p refs
(Contract DA-18-108-405-CML-824)
(Rept.-2381; AD-600757)

This is a fundamental study of factors affecting the flow and dispersibility of finely divided organic powders. Most of the investigations pertain to four base powders: saccharin, Carbowax 6000, Span 60, and egg albumin. These powders were chosen to represent crystalline, waxy, and gummy types of powders. The preparation of powders including grinding, deagglomeration, blending, and coating with surface active agents is discussed. The various tests for measuring physical properties of powders including particle size distribution, shear strength, bulk tensile strength, bulk density, dynamic angle of repose, dispersibility, and electrostatic charge are described. Experimental data are presented in tabular and graphical forms for: (1) bulk tensile strength tests; (2) effects of humidity on powder properties; (3) effects of antiagglomerant agents on powder properties; (4) mechanism by which Cab-O-Sil functions; (5) effects of surface active agents on powder properties; (6) effects of adsorbed foreign vapors on powder properties; (7) effects of removal of adsorbed gases and vapors; (8) energy required to disperse a powder sample; (9) properties of compacted powders; and (10) egg albumin studies. Author

N64-21616 Los Alamos Scientific Lab., N. Mex.
INVESTIGATION OF COUPLED ROVER CORES
R. L. Seale 20 May 1964 32 p refs OTS: $0.75
(Contract W-7405-ENG-36)
(LAMS-2968)

The effect of operating four Rover reactors in a clustered array has been investigated in an attempt to establish the extent of the interaction at zero power between the individual cores in the array and to identify any fundamental limitation that may compromise such operation. The study of the static behavior of the array shows that the average flux level in each core is strongly influenced by the relative reactivity setting of that core. This implies that the performance of each core in the array should be monitored individually. The kinetic analysis indicates that there are no neutronic induced resonances in the system for the values of coupling parameters of interest in Rover-type systems. There appear to be no fundamental limitations imposed by neutronics in the operation of coupled arrays at zero power. Author

N64-21670 National Bureau of Standards, Washington, D.C. Metrology Div.
INFRARED OPTICAL MEASUREMENTS Semiannual Technical Report, Jul. 1–Dec. 31, 1963
R. H. Munis et al [1964] 22 p refs
(ARPA Order 376-62)
(NBS-8302; AD-434237)

This reports the progress and status of a program of development of standard measurement procedures and measurement of infrared optical materials. The emissivity of a sample of La-Lu doped glass was measured at 673° K from 1.7μ to 14.5μ. The temperature of the radiating surface was computed to be 95° K lower than the temperature of the rear surface (673° K). The spectral transmittance of 2-mm-, 8-mm-, and 16-mm-thick samples of KBr was measured from 2.5μ to 25μ wavelength. An IR image converter tube set at the viewing end of the Wild spectrometer enabled measurement to be made of the refractive indices of several materials from 0.4047μ to 1.014μ. A.W.

N64-21724 RAND Corp., Santa Monica, Calif.
ELECTROMAGNETIC SIGNALS PRODUCED BY LOW-ALTITUDE NUCLEAR EXPLOSIONS
W. J. Karzas and R. Latter Dec. 1963 30 p
(Contract AF 49(638)-700; Proj. RAND)
(RM-3384-PR; AD-429404)

Specifically, a simplified model of the explosion is treated analytically. The model assumes the explosion takes place at a height h above an infinitely conducting ground. The ambient air is assumed to have a uniform and constant conductivity, and the explosion is approximated as a point source of gamma rays. This model is solved analytically for the magnetic field at any point about the explosion. Some numerical results illustrate the time space variation of the magnetic field. Author

N64-21730 Nihon U., Tokyo (Japan) College of Science and Engineering
ON THE INTERMEDIATE BOSON HYPOTHESES OF WEAK INTERACTIONS
Kunio Itami, Seitaro Nakamura, (Tokyo U.) Nobumichi Mugibayashi, and Yasutaka Tanikawa (Kobe U.) [1964] 11 p refs
(NUP-64-4)

The intermediate boson theory of weak interaction was proposed by Yasutaka Tanikawa and S. Watanabe. Some inferences of this theory that could be tested by neutrino experiments are presented; these are the resonant and nonresonant neutrino elastic processes, the angular distribution of muons, and the inelastic neutrino process. R.T.K.

N64-21771 Comitato Nazionale Per L'Energia Nucleare, Frascati (Italy)
NUCLEAR DYNAMIC POLARIZATION
V. Montelatici 21 Mar. 1963 12 p refs *Its* Internal Note 187
(LNF-63/15)

The nuclear dynamic polarization steady state is described from the thermodynamical and statistical view points. It is shown how the nuclear population in some cases is inverted, giving rise to a radiofrequency amplification by stimulated emission. Author

N64-21790 Atomics International, Canoga Park, Calif.
BOOMER—A DIGITAL PROGRAM FOR EVALUATING THE THERMAL AND KINETICS RESPONSE OF A SNAP 2/10A REACTOR
R. W. Winson 31 May 1964 75 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-8414) OTS: $1.75

A mathematical model of the SNAP 2/10A reactor was developed describing the reactor kinetics, heat transfer, and hydrogen diffusion within the reactor core. This theoretical model was then modified, on the basis of current test data, to realistically predict the transient response of the reactor. The model was then programed into a digital code called BOOMER. The development of this code is described in detail. The code solves the spatially discretized partial differential equations representing the heat transfer and hydrogen diffusion within an average fuel rod, the six-delay group monoenergetic kinetic equations, and all the necessary coupling equations. The output of the code presents the time solution of the SNAP 2/10A reactor transient and includes the temperature distribution in the coolant channel, distributed hydrogen concentration, hydrogen pressure within cladding gap, reactor power, neutron flux, and the concentrations of the delayed neutron precursors. The primary function of BOOMER is to represent the response of the reactor to large reactivity ramp and step insertions. Author

N64-21807 Naval Research Lab., Washington, D.C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY Progress Report, Apr. – Jun. 1963
A. H. Aitken et al 1 Jul. 1963 28 p refs
(AD-434279)

Activities in two areas of research are discussed: (1) nuclear physics—a construction of the representation of SU(3), representations of SU(3), bibliography of photonuclear and electronuclear disintegrations, a beam-dump magnet design, and (2) beam and plasma physics—considerations in the alignment of a long electron beam subject to many small zero-gradient scattering forces, high-voltage silver-mylar capacitors, precision manometers for accurate leveling of sozotron lenses. P.V.E.

N64-21824 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group Research Lab.
SOME TOPICS ON MECHANICS OF VARIABLE MASSES TAKING INTO ACCOUNT THE INTERNAL MOTION OF PARTICLES, PART I
V. S. Novoselov 3 Dec. 1959 19 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekhan. i Astron., [v.] 19, 1956 p 100–113
(MH-TRANS-104)

This article brings a generalization of the I. V. Meshcherskii equation on the case of the relative motion of particles. After that laws were achieved for the change of the principal vector quantity of motion and of the kinetic moment, but also

resulting from those laws mechanical consequences for systems and bodies of the variable mass in a general case, at a possible relative motion of the particles. The theoretical considerations are illustrated by examples. Equations of motion will be derived from the stated mechanical systems with holonomic as well as nonholonomic ties in the generalized Lagrange and nonholonomic coordinates. Also discussed are some problems of variable masses mechanics. Author

N64-21825 Minneapolis-Honeywell Regulator Co., Minn. Military Products Group

SOME TOPICS ON MECHANICS OF VARIABLE MASSES TAKING INTO ACCOUNT THE INTERNAL MOTION OF PARTICLES, PART II

V. S. Novoseloy [1957] 25 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekhan. i Astron., no. 1, 1957 p 130–140

(MH-TRANS-105)

This article investigates the law of kinetic energy change for a system and body of the variable mass. For the holonomic systems with variable masses in a general case, at a possible relative motion of the particles, the second kind of the Lagrange equations has been obtained. Stated are the necessary and sufficient conditions for which, carried out in the mechanics of variable masses, the Hamilton–Ostrogradskii principle is satisfied. The theoretical investigations are illustrated by examples. Author

N64-21903 Brookhaven National Lab., Upton, N.Y.

INTERNATIONAL CONFERENCE ON FUNDAMENTAL ASPECTS OF WEAK INTERACTIONS

Apr 1964 462 p refs Conf. held at Brookhaven Natl. Lab., 9-11 Sep. 1961

(BNL-837(C-39)) OTS: $5.50

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N64-21904 Aerojet-General Corp., Downey, Calif. Research and Engineering Div.

METHODS OF DESCRIBING DROPLET-SIZE DISTRIBUTIONS FROM ATOMIZED SOLUTIONS

R. E. Brown and K. L. Leonard 28 Feb. 1964 150 p refs (Contract DA-18-108-405-CML-829)

(Rept.-0395-04(15)SP; AD-434106)

Several mathematical methods were investigated to determine a technique for describing droplet-size distributions

produced by pneumatic atomization. The Weibull and log-probability functions have been shown to be reasonably successful in describing these distributions. Data from 43 experiments and the standard deviation of the experimental results from the theoretical curves for both the mass and the frequency distributions are reported. These results show that the Weibull and log-probability functions describe the frequency distribution with the same degree of accuracy, but the Weibull function describes the mass distribution better. Author

N64-21910 RAND Corp., Santa Monica, Calif.
RADIATIVE TRANSFER IN FINITE HOMOGENEOUS ATMOSPHERES WITH ANISOTROPIC SCATTERING—II: THE UNIQUENESS PROBLEM FOR CHANDRASEKHAR'S ψ_ℓ AND ϕ_ℓ EQUATIONS
T. W. Mullikin Feb. 1964 54 p refs
(Contract AF 49(638)-700; Proj. RAND)
(RM-3909-PR; AD-430828)

A study is made of the existence and uniqueness problems for Chandrasekhar's ψ_ℓ and ϕ_ℓ equations for radiative transfer in homogeneous atmospheres with anisotropic scattering. It is shown that for many phase functions these nonlinear equations have one-parameter families of solutions. It is shown also that the unique solution that corresponds to the solution of the radiative-transfer problem must satisfy certain linear constraints in addition to Chandrasekhar's nonlinear equations. Author

N64-21911 RAND Corp., Santa Monica, Calif.
A NOTE ON NONLINEAR SUMMABILITY TECHNIQUES IN INVARIANT IMBEDDING
Richard Bellmann and Robert Kalaba Feb. 1963 17 p refs
(Contract AF 49(638)-700)
(RM-3397-PR; AD-296295; Proj. RAND)

The application of nonlinear summability techniques to radiative transfer is discussed. The fundamental assumption of the work is the existence of an asymptotic expansion of the form $f_n \sim f_\infty + \sum_k a_k e^{-\lambda_k n}$ as $n \to \infty$, or that f_n can be sensibly approximated by an expression of the type $\sum_k a_k e^{-\lambda_k n}$. The function f_n is taken to have the simple form $f_n = f_\infty + ae^{bn}$, and f_∞ is calculated to give the simple nonlinear predictor:

$$f_\infty = \frac{\begin{vmatrix} f_n & f_{n+1} \\ f_{n+1} & f_{n+2} \end{vmatrix}}{(f_n + f_{n+2} - 2f_n)}$$

Experiments in radiative transfer (including time-dependent processes and gradient techniques) using this predictor are described. P.V.E.

N64-21925 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COHERENT RADIATION OF SYNCHROTRON ELECTRON CLUSTERS IN A CLOSED RESONATOR
J. Vaclavik 1 Mar. 1963 12 p refs Transl. into ENGLISH from Chekhoslovatskiy Fiz. Zh. (Czech.), v. 12, no. 6, 1962 p 432–438
(FTD-TT-62-1747/1+2+4; AD-299644)

A study is made of the electromagnetic interaction of electrons in thin relativistic clusters during coherent radiation in a synchrotron. An expression is found for the tangential component of the force with which electron clusters act on an individual electron. Author

N64-21927 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
JOURNAL OF ENGINEERING PHYSICS (SELECTED ARTICLES)
5 Mar. 1963 13 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 5, no. 7, 1962 p 18–22, 28–33
(FTD-TT-1804/1+2+4; AD-400529)

Two articles are discussed. One article deals with the effect of diffusion factors on flame stability. Causes for the deviation from the universal relationship of experimental values of critical velocities of flame blowoff from small stabilizers are considered. The investigation was carried out with a gasoline–air mixture, using conical and cylindrical stabilizers. The other article deals with an investigation of heat exchange in the horizontal surfaces of heat insulating structures, slotted with metallic structures, in systems of deep cooling. The values of the coefficient of heat exchange obtained are compared with its calculated values derived by various means. I.v.L.

N64-21961 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CRITICAL EXPERIMENT AS A MEANS OF REVEALING THE PHYSICAL CHARACTERISTICS OF A REACTOR
V. A. Kuznetsov 20 Nov. 1963, 15 p refs Transl. into ENGLISH from Simpozium po Eksponentsial'nym i Kriticheskim Eksperim., Mezhdunarodnoye Agentstvo po At. Energ., Amsterdam, 2–6 Sep. 1963 p 1–11
(FTD-TT-63-978/1; AD-425498)

The critical experiment discussed is carried out on a USSR physical stand, the Pf-4, that is provided with a pulse neutron generator and a neutron accelerator in addition to the ordinary reactor zero-power equipment. Such a critical experiment permits, among other things, the assemblage of sufficiently simple critical systems, a change within broad limits of the system characteristics, and a thorough investigation of the critical parameters of the spatial energy distribution in the reactor. I.v.L.

N64-21982 Air Force Systems Command, Wright-Patterson AFB, Ohio Research and Technology Div.
ANALYSIS OF GENERALIZED OPTICAL ARRAYS
Edwin B. Champagne Dec. 1963 30 p refs
(RTD-TDR-63-4138; AD-431567)

The extension of the present array theory to arrays of optical sources is beset with difficulties, and some of these difficulties are studied. Statistical theory is applied to a generalized array in an attempt to predict what degradation of array factors may be anticipated for such factors as amplitude deviations, various polarizations, frequency bandwidths, phase deviations, and mechanical alignment errors. Author

N64-21998 Brookhaven National Lab., Upton, N.Y.
AN EXTENDED TABLE OF NUCLIDIC MASSES
Manny Hillman Mar. 1964 145 p refs
(BNL-846(T-333)) OTS: $2.50

About 7,000 nuclidic masses were calculated based on parabolic systematics. The parabolic parameters, the masses, and energies available for emission of negatrons, positrons, neutrons, protons, and alpha particles are tabulated. The known nuclidic masses are compared with the calculated masses. Author

N64-22005 Massachusetts Inst. of Tech., Cambridge Lab. for Insulation Research
FREQUENCY AND TEMPERATURE RESPONSE OF THE POLARIZATION OF BARIUM TITANATE

Joseph M. Ballantyne Mar. 1964 37 p refs
(Contracts AF 33(616)-8353; Nonr-1841(10))
(TR-188; AD-435903)

The frequency and temperature response of the polarization of $BaTiO_3$ from 0 to 1000 cm^{-1} and between 24° and 200° C has been determined by transmission and reflectivity measurements. The infrared transmission of thin single-crystal $BaTiO_3$ has been recorded from 250 to 4000 cm^{-1}; a single absorption band located at 491 cm^{-1} was observed. The reflectivity of single-domain $BaTiO_3$ has been measured continously from 10 to 4000 cm^{-1}, and at points of 0.77, 5, and 10 cm^{-1}. A drop in reflectivity occurs from 10 to 70 cm^{-1}, and absorption bands are located near 175 and 470 cm^{-1}. Measurements of the dielectric constant of single-domain crystals at 0.77 cm^{-1} (24 kMc) yielded permittivities of about 1500, indicating no relaxation from the low-frequency dielectric constant. Temperature-dependent splittings of the absorption bands at 175 and 470 cm^{-1}, observed in the reflectivity, are caused by changes in crystal symmetry. Reflectivity analysis indicates that the dispersion of the polarization in single-domain $BaTiO_3$ from 1 to 1000 cm^{-1} consists of three resonances, at 12, 182, and 491 cm^{-1} Author

N64-22018* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESONANCE SCATTERING AT LYMAN-ALPHA BY AN ATOMIC HYDROGEN CELL
J. E. Blamont, P. Delache, and A. K. Stober (Centre Natl. de la Rech.) Washington, NASA, 1964 10 p refs
(NASA-TN-D-2148) OTS: $1.50

This paper describes the experimental conditions for direct photoelectric observation of the optical resonance and polarization of the hydrogen Lyman-alpha line. Author

N64-22043 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ELASTIC DEUTERON REACTIONS IN THE IMPULSE APPROXIMATION
H. Gourdin Feb. 1964 26 p refs
(TH-46)

A description is presented of "elastic" deuteron reaction in the framework of the impulse approximation, by calculating the deuteron target amplitude in terms of the corresponding nucleon target amplitudes. The presence of the deuterium appears, essentially, in two features. The first is in the definition of four structure functions that depend only on the deuterium, and can be calculated for all problems by using the deuteron radial S and D wave functions u(r) and w(r). Secondly, the factor 2/3 is present in front of the spin-flip nucleon amplitudes, which is due to the deuteron spin. P.V.E.

N64-22044 Argonne National Lab., Ill.
A COMPARISON OF NUCLIDIC MASS EQUATIONS WITH EXPERIMENTAL DATA
James Wing Jan. 1964 87 p refs
(Contract W-31-109-ENG-38)
(ANL-6814)

Existing mathematical expressions for the sytematics of the nuclidic masses, binding energies, and nucleon separation energies are summarized. The calculated values of the nuclidic mass equations of Fermi, Román, Bussetti, Cameron, Tsen, Findler, Seeger, Ayres et al., Kümmel et al., Thieberger et al., Zeldes, Green, Levy, Baker, and Wing–Fong (a new mass equation) are compared with the available experimental data. Improvements are suggested for some of the observed deviations in these equations. Some expressions for the isobaric parameters B_A and Z_A (nuclear charge of the most stable isobar), and for the pairing and shell effects are compared with the experimental evidence. An improved empirical formula for Z_A and empirical equations for the deformation parameter β are presented. Author

N64-22052 Harvard U., Cambridge, Mass. Cruft Lab.
STATISTICAL FLUCTUATION IN NONLINEAR OPTICAL PROCESSES
J. Ducuing and N. Bloembergen 18 Nov. 1963 44 p refs
(Contract Nonr-1866(16))
(TR-430; AD-434890)

Second-harmonic generation is considered, and it is shown that the presence of several incoherent modes in the laser beam leads to a discrepancy between the real and the measured nonlinear constant, and introduces a certain amount of randomness in the ratio between the square of the fundamental intensity and the second-harmonic intensity. Experimental results with a single-pulse ruby laser are described that demonstrate the part played by the spatial modes in the mechanism of fluctuations of the second-harmonic production. The theory of fluctuations in higher order nonlinear processes is briefly discussed. Conversion and related experiments are presented considering the case of microwave generation. It is shown that a reduction factor for the generation of beats in a photocathode should be taken into account in this experiment. N.E.A.

N64-22112 Rochester U., N.Y.
ELEMENTARY PARTICLES AS ELEMENTARY PARTICLES
C. R. Hagen 19 May 1964 33 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-33)

The $Z = 0$ rule is investigated within a general field theoretic formulation. The equivalence of a system with an elementary particle of vanishing wave function renormalization to a direct interaction theory is intimately related to the divergence of the bare mass and the consequent degeneration of the equations of motion. The results obtained are fully illustrated in terms of appropriately generalized versions of Zachariasen's model. Any field theoretic approach treating all particles as being equally elementary is subject to severe criticism and can derive no support whatever from the $Z = 0$ rule. Author

N64-22113 Rochester U., N.Y.
AXIAL VECTOR CURRENT IN BROKEN UNITARY SYMMETRY
Riazuddin 20 May 1964 18 p refs Submitted for Publication
(Contract AT(30-1)-875)
(UR-875-34)

By using Goldberger–Treiman-type relations and the octet version of broken unitary symmetry with the symmetry-breaking interaction behaving as T_3^3 or λ_8, Cabibbo's assumptions regarding the axial vector interaction for leptonic decays of strongly interacting particles are justified. Author

N64-22115 Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
RESEARCH ON TECHNIQUES FOR LIGHT MODULATION DETECTION Interim Engineering Report No. 7, 1 Dec. 1963–1 Mar. 1964
E. O. Ammann 20 Mar. 1964 31 p refs
(Contract AF 33(657)-8995)
(EDL-M670; AD-434127)

Research is being conducted for the detection of light that has been modulated at a microwave (or higher) frequency. Devices capable of detecting this modulation are being sought. Work has continued on FM demodulation methods, and has reaffirmed an earlier conclusion that FM to AM conversion, using birefringent crystals, is the most promising method consistent with the objective of this program. New results are described in the following areas: (1) The synthesis procedure that yields a filter containing N birefringent crystals, N bias units, and N + polarizers has been improved, thereby maximizing the filter output. (2) A technique is proposed for modifying the birefringent discriminator so that it can accommodate light of any polarization. R.T.K.

N64-22117 Princeton U., N.J. Plasma Physics Lab.
FINITE-RESISTIVITY INSTABILITIES OF A SHEET PINCH WITH FIRST ORDER GYRATION RADIUS CORRECTIONS
Russell M. Kulsrud Mar. 1964 21 p refs
(Contract AT(30-1)-1238)
(MATT-258)

The effect of a first-order ion gyration radius correction on the growth rates of the resistive instabilities of Furth, Killeen, and Rosenbluth is investigated. It is found that, if the electrons are treated as a fluid, this correction may be made by replacing the ion mass velocity by the E×B drift and adding a single term to the basic equations. The resulting modified dispersion relation for these instabilities is given, and its consequences in certain limiting situations is developed. It is found that contrary to the result of infinite conductivity instabilities, the resistive instabilities cannot be stabilized. They are only slowed down moderately and made overstable by this correction. Author

N64-22136 European Atomic Energy Community, Brussels (Belgium)
STANDARDIZATION OF COBALT-58 [STANDAARDISATIE VAN COBALT-58]
R. Vaninbroukx and G. Grosse Joint Nucl. Res. Center, Geel Estab., Mar. 1964 30 p refs In DUTCH; ENGLISH Summary
(EUR-524.n) Available from Belgian Am. Bank and Trust Co., N.Y.: 40 Belg. Fr.

A relative method for measuring Co^{58} with 1% accuracy is described in detail. Use is made of a γ-spectrometer, which is calibrated, in function of the γ energy, by different sources standardized with high precision in a $4\pi\beta$-γ coincidence counter. Author

N64-22146 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON ANGULAR DISTRIBUTION OF IONS OF ALKALI ELEMENTS, DIFFUSED BY THE SURFACE OF METAL
U. A. Arifov, A. Kh. Ayukhanov, and A. A. Aliyev 18 Feb. 1963 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk (USSR), no. 6, 1961 p 57–64
(FTD-TT-62-1719/1+2; AD-400526)

An investigation of the intensities and energies of secondary ions, with respect to their angular distribution resulting from the bombardment of metal surfaces with ions, is described. In the present experiment, tantalum was used as the bombarded surface and sodium ions as the incident ions. Conclusions reached as a result of the investigation include the following: (1) When the mass of the incident ions is lower than the mass of the target atoms, the distribution of scattered ions by angles coincides closely with the cosine curve. (2) The distribution of the intensity of the scattered ions by angles, for the range of primary ion energies investigated, does not depend upon the energy of the bombarding ions and temperature of the target. (3) For all angles of primary beam incidence, the distribution of intensity of scattered ions by angle coincides with a cosine curve. (4) With an increase in angle-of-incidence of primary ions, the coefficient of secondary scattered ions increases. P.V.E.

N64-22191 General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
VBWR STABILITY TEST REPORT
J. M. Case et al Washington, AEC, Jun. 1963 372 p refs
(Contract AT(04-3)-189)
(GEAP-3971) OTS: $4.50

Power-stability tests conducted in the Vallecitos Boiling Water Reactor (VBWR) are summarized. Tests were conducted with both natural and forced-circulation coolant flow over a wide range of flows and powers. Instrumentation, in addition to regular process instruments, included five bundles with the provision for measuring inlet flow rate, neutron flux at three axial core locations, pressure drop, and temperature. P.V.E.

N64-22193* Space Technology Labs., Redondo Beach, Calif. Physical Research Div.
ION EMITTER STUDIES Final Report
A. Cho and H. Shelton 11 May 1961 88 p refs
(Contract NAS3-2524)
(NASA-CR-54045; Rept.-8413-6014-SU-000) OTS: $8.10 ph

The effect of impurities on the cesium ion and neutral emission from hot porous tungsten are presented. These impurities include oxygen, carbon, calcium, silicon, boron, fluorine, and chlorine. The cesium neutral fraction and the critical temperature, when the clean or contaminated porous tungsten is emitting ions, are correlated with the work function and cesium binding energy inferred from the electron emission S-shaped curve. Author

N64-22195 Princeton U., N.J. Plasma Physics Lab.
DESIGN OF FORCE-FREE TOROIDAL MAGNETS
Kenneth E. Wakefield Mar. 1964 20 p refs
(Contract AT(30-1)-1238)
(MATT-208)

This paper describes a dual element coil system in which one element, comparable to the confining field coil system of a stellarator, generates a toroidal field by means of a force-free, thick layer of conductors. The second, remote element, consisting of simple coil shapes that can more easily be supported, carries the only forces in the system. Physical characteristics of the system, such as the size and shape of the experimental cavity, the thickness of the force-free layer, and the location and size of the force-bearing member, can be controlled through suitable choice of values for a number of free parameters. The details of a particular force-free design are accurately determined by means of a complex computer procedure. The point-by-point winding prescription thus obtained can be used to fabricate a coil in which only the small, unavoidable forces due to imprecise location of the conductors are present. Author

N64-22197 European Atomic Energy Community, Brussels (Belgium)
DEVICE FOR THE DETERMINATION OF THE PURITY OF REACTOR-GRADE MATERIALS BY THE OSCILLATION METHOD [DISPOSITIF DE MESURES DE LA PURETE NUCLEAIRE DES MATERIAUX PAR LA METHODE D'OSCILLATION]

A. Anzani, I. Bredael, and F. Sciuto Joint Nucl. Res. Center, Ispra Estab. (Italy), Regulation–Automation Serv., Mar. 1964 35 p refs In FRENCH; ENGLISH Summary
Available from Belgian Am. Bank and Trust Co., N.Y.; Account No. 121.86: 50 Belg. Fr.
(EUR-523.f)

In a nuclear reactor, if the reactivity of the periodic oscillations is subject to the criticality, the neutronic flux is subject to oscillations that have the same duration. If the reactive modulation is obtained by periodically displacing an absorber with both a high-flux zone and a low-flux zone, the amplitude of the oscillating function representing the flux is proportional to the absorber's efficiency. This report describes test equipment for the measurement of the nuclear purity of materials by the oscillation method with the nuclear reactor AGN-201 Costanza. Results were obtained by pulse techniques that gave high accuracy and flexibility. G.D.B.

N64-22219 Lockheed Missiles and Space Co., Sunnyvale, Calif.
NEUTRON FLUX MEASUREMENTS: AN ANNOTATED BIBLIOGRAPHY
Charlie M. Pierce, comp. Sep. 1963 65 p refs
(SRB-63-7; LMSC-6-90-63-96)

The references cited deal with all aspects of neutron flux measurements. Most of the references were published between June 1959 and June 1963. The references are alphabetically arranged according to the first author. Corporate and personal author indexes are included. Author

N64-22223 Illinois U., Urbana Coordinated Science Lab.
NONLINEAR OSCILLATIONS IN A SECOND ORDER SYSTEM
Peter James Ponzo Jan. 1964 106 p refs
(Contract DA-36-039-AMC-02208(E))
(R-193; AD-433472)

Relaxation oscillations as described by the equation $\ddot{x} + \mu f(x)\dot{x} + g(x) = 0$, $\mu >> 1$, are investigated in the plane defined by $\dot{x} = \mu(y - F(x))$, $\mu\dot{y} = -g(x)$ where $F(x) = \int_0^x f(u)du$. A number of analytic curves are obtained to serve as upper and lower bounds on solution trajectories in this plane. In many cases, piecewise connection of such bounding curves provide annular regions within which periodic orbits lie. The number, location, stability, and amplitude bounds of periodic solutions may be determined in this manner. When the method is applied to the equation of van der Pol, the upper and lower bounds obtained for the amplitude of the unique periodic solutions compare favorably with the known asymptotic expansion of the amplitude in terms of μ. Forced oscillations described by the equation $\ddot{x} + \mu f(x)\dot{x} + g(x) = p(t)$, $\mu >> 1$, are investigated in the plane defined by $\dot{x} = \mu(y - F(x)) + P(t)$, $\mu\dot{y} = -g(x)$, where $P(t) = \int^t p(\tau)d\tau$ is bounded for all t. Forced solution trajectories may be confined to lie between the trajectories of two associated autonomous systems. In some cases, both associated systems admit periodic orbits whose limit cycles serve to define the boundaries of annular regions in the plane. These annuli, when they exist, confine forced trajectories in their interior. Some of the analytic properties of such confined trajectories are discussed and numerical solutions presented. Author

N64-22228 Wien U. (Austria)
PHONON DRAG EFFECT AND TRANSPORT COEFFICIENTS
Walter E. Thirring [1964] 4 p
(Contract DA-91-591-EUC-2920)
(TSR-3)

Research dealing with higher-order corrections to electrical conductivity and with the conductivity of impurity bands is summarized. P.V.E.

N64-22231 Allis-Chalmers Mfg. Co., Milwaukee, Wis. Atomic Energy Div.
LARGE FAST REACTOR DESIGN STUDY Final Report
C. Klotz et al Jan. 1964 292 p refs
(Contract AT(11-1)-1316)
(ACNP-64503)

This study was undertaken to establish the preliminary characteristics of a 1,000-mwe sodium-cooled fast-breeder reactor. The reactor concept studied employed stainless steel clad plutonium–uranium oxide fuel. The results of the study show that a practical 1,000-mwe reactor with an outlet temperature of 1,200° F and a breeding ratio of 1.32 can be designed having a fuel cycle cost of 0.69 mills/kwhr at 0.8 plant factor. The use of an annular core has resulted in essentially eliminating the large positive sodium-void-reactivity coefficient normally found in a core of this volume. The annular core geometry allows the use of an efficient radial blanket, which achieves a high conversion ratio without making the blanket excessively thick. Author

N64-22236 Arizona U., Tucson
REACTOR KINETICS AND CONTROL
Lynn E. Weaver Oak Ridge, Tenn. AEC, Apr. 1964 594 p refs Proceedings of a Symp. held at Arizona U., Tucson, 25–27 Mar. 1963 AEC Symp. Series no. 2
(TID-7662) OTS: $4.25

The papers contained in this publication present recent developments in, and cover the broad spectrum of, reactor dynamics and control from theoretical studies to experimental results. Author

N64-22250 General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science
INTEGRAL NEUTRON THERMALIZATION Annual Summary Report, Oct. 1, 1962 – Sep. 30, 1963
J. R. Beyster, J. R. Brown, J. U. Koppel, J. M. Neill, J. L. Russell, Jr. et al 24 Jan. 1964 201 p refs
(Contract AT(04-3)-167)
(GA-4659) OTS: $3.00

Research was carried out in the following areas: (1) neutron thermalization in water, deuterium oxide, polyethlene, benzene, zirconium hydride, and beryllium; (2) beryllium scattering-model development; (3) development of a pulsed critical assembly; (4) fast-neutron shielding studies; (5) universal scattering-kernel code; (6) cadmium-curtain experiments; and (7) asymptotic (diffusion-cooled) neutron spectra. P.V.E.

N64-22256 Oak Ridge National Lab., Tenn. Neutron Physics Div.
NUCLEON-MESON CASCADE CALCULATIONS: TRANSVERSE SHIELDING FOR A 45-GEV ELECTRON ACCELERATOR (PART III)
R. G. Alsmiller, Jr., F. S. Alsmiller, and J. E. Murphy 28 Mar. 1963 30 p refs
(Contract W-7405-ENG-26)
(ORNL-3412) OTS: $0.75

Nucleon-meson cascade calculations were previously carried out for several cases of interest in the design of the transverse shield for the proposed 45-Gev linear electron accelerator at Stanford University. In this report results are given for two additional cases. The equations, notation, and method of calculation are the same. The results are given along with some

details concerning the dose calculation. The neutron, proton, pion, and muon intensities as a function of energy and distance for $\theta = 50°$ and $110°$ are given. The neutron dose contains an estimated contribution from low-energy neutrons, but the proton, pion, and muon doses are calculated by considering only those particles whose energies exceed 32 Mev. The muon dose for $\theta = 50°$ has a very different slope than do the neutron, proton, and pion doses for this case. Author

N64-22257 Michigan State U., East Lansing Ultrasonics Lab.
THE PROPAGATION OF HIGH AMPLITUDE SOUND WAVES: FORTRAN PROGRAM FOR ENERGY RATIOS OF REFLECTED AND REFRACTED WAVES AT FLAT BOUNDARIES
Walter G. Mayer Apr. 1964 13 p refs
(Contract Nonr-2587(01))
(TR-9; AD-433810)

The equations for the energy ratios of reflected and refracted to incident longitudinal ultrasonic waves are programed for FORTRAN. The ratios are determined as a function of angle-of-incidence for liquid–solid, solid–liquid, solid–vacuum, or solid–solid flat interfaces. No assumptions are required concerning densities and relative magnitudes of the various wave velocities. Energy ratios are also calculated for critical angles, if they exist. The entire program and comments are given. Author

N64-22259* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
A PARAMETRIC STUDY OF DIRECT NUCLEAR ELECTROGENERATOR CELLS USING A BETA EMITTING SOURCE
Allan J. Cohen and Charles A. Low, Jr. N.Y., AIAA [1963] refs Presented at the AIAA Electric Propulsion Conf., Colorado Springs, 11–13 Mar. 1963
(AIAA Paper-63048-B)

A design analysis has been completed for direct nuclear electrogenerator cells, using the beta emitting radioisotope cerium 144. Cylindrical and spherical geometries were studied to determine the minimum weight per unit power. The main details of the mathematical operations performed by the computer are outlined along with information pertinent to the input requirements and results of the program. The simple calculations necessary to complete the description of the specific cells are indicated. The cell characteristics that result from these procedures are the operating voltage, current and power per unit area, the temperatures of the emitter and collector, and the weight per unit power. As a result of these studies, a few designs are presented that can have weight-to-power ratios of 0.3 to 0.5 kg/kw. Author

N64-22323 Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
EXPERIMENTAL METHOD OF DETERMINING THE VELOCITY OF SOUND IN GRAPHITE
A. F. Di Giacomo 30 Apr. 1964 19 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-80; TDR-269(4240-30)-6; AD-600876)

A new experimental technique was developed to determine the plate velocity of sound in graphite. This technique uses a thin cylindrical shell specimen and is less dependent on test specimen boundary condition than the standard beam vibration test. Results of the dynamic Young's modulus tests were in excellent agreement with static measurements made on the same test specimens. Author

N64-22331 Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
DIFFERENTIAL EQUATIONS FOR THE FIELD AMPLITUDE IN INHOMOGENEOUS MEDIA
R. M. Lewis and J. B. Keller Mar. 1963 19 p refs
(Contract DA-36-034-ORD-3144Z; ARPA Order-51)
(DAMP-TM-63-04; AD-404475)

This paper develops differential equations to describe the energy density amplitude variation in three dimensions along a space curve or ray in media of changing index of refraction. A system of variational equations is established that defines the first order variation of rays in the immediate vicinity of a given ray. These are then used to develop the coefficients of the ray equation. The system is checked by reducing the order of the differential equations to the two-dimensional case and thereby obtaining Kay's equation. Author

N64-22385 University of Southern Calif., Los Angeles School of Engineering
PERTURBATION APPROACH TO THE DIFFRACTION OF ELECTROMAGNETIC WAVES BY ARBITRARILY SHAPED DIELECTRIC OBSTACLES
Cavour W. H. Yeh Mar. 1964 31 p refs
(Contract AF 19(609)-6195)
(USCEC-82-216; AFCRL-64-260; EE-36; AD-601002)

A perturbation method is developed to consider the problem of the diffraction of electromagnetic waves by an arbitrarily shaped dielectric obstacle whose boundary may be expressed in the general form, in spherical coordinates,

$$r_p = r_0(1 + \delta f_1(\theta,\phi) + \delta^2 f_2(\theta,\phi) + \ldots)$$

where r_0 is the radius of an unperturbed sphere and $f_n(\theta,\phi)$ are arbitrary, single-valued, and analytic functions. The δ is chosen such that

$$\sum_{n=1}^{\infty} |\delta^n f_n(\theta,\phi)| < 1, \quad 0 \le \theta \le \pi, \quad 0 \le \phi \le 2\pi.$$

Detailed analysis is carried out to the first order in δ. Procedures to obtain higher order terms are also indicated. The perturbation solutions are valid for the near zone region of the obstacle as well as for the far zone region and they are applicable for all frequencies. Author

N64-22402 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE THEORY OF AN ASYNCHRONOUS MAGNETOHYDRODYNAMIC GENERATOR WITH A ROTATING FIELD
Ye. I. Yantovskiy and I. M. Tolmach 4 Feb. 1963 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Energ. i Avtomat. (USSR), no. 3, 1962 p 32–41
(FTD-TT-62-1797/1+2+4; AD-299635)

In a previous article equations were presented that describe the flow of a conducting gas in a magnetohydrodynamic generator (MHDG) with a rotating field. In the present article these equations are generalized by taking into account the dependence of the conductivity of the gas on the temperature and density, by not averaging with respect to the transverse coordinate and time, and also by taking into account the voltage drop across the stator winding and the characteristics of the winding. A system of equations for an actual scheme of an asynchronous MHDG is obtained. The concept of vector diagrams of an a.c. MHDG is introduced. The process of the direct conversion of a part of the kinetic energy of the gas to electrical energy and its entry into the network is illustrated with the aid of local and overall vector diagrams. Author

N64-22410 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
NEW LOW VOLTAGE SOURCES OF VACUUM ULTRAVIOLET

Ye. M. Akimov 15 Mar. 1963 16 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. Mat., Mekhan., Astron., Fiz., Khim. (Moscow), no. 4, 1958 p 109–118
(FTD-TT-62-1913/1+2; AD-402434)

Results of various investigations indicate the following: (1) A stable vacuum arc at currents of 5 to 7 amp can be obtained between a carbon cathode and a high-melting metal anode by rapidly separating the electrodes to a distance of 3 to 5 mm, provided a high-frequency high voltage is applied to the d.c. current. (2) A contact spark–low voltage spark has been achieved between two weakly contacted electrodes, one of which is carbon. The spark originates during the discharge of a high-capacitance capacitor. The spark develops a temperature sufficiently high to excite the spectra of repeatedly ionized atoms. (3) A source of vacuum ultraviolet was realized by combining a breaking vacuum arc with a capacitor discharge. Extensive evaporation of the electrode material occurs, and a high-temperature-breaking condensed arc is achieved. I.v.L.

N64-22435 Laboratoire de Physique Theorique et Des Hautes Energies, Orsay (France)
A COVARIANT THEORY OF RELATIVISTIC BROWNIAN MOTION. I: LOCAL EQUILIBRIUM
Remi Hakim May 1964 51 p refs
(Th.-51)

Some relativistic methods in statistical mechanics and their applications to the construction of a covariant theory of brownian movement are discussed. Times that are long compared with the relaxation time β^{-1} are given exclusively. As a consequence of this covariant theory, relativistic Wiener integrals are derived. Author

N64-22476 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
OPTICOMECHANICAL INSTRUMENTS
Nandor Barany and Laszlo Mitnyan 30 Jan. 1964 1293 p refs Transl. into ENGLISH of the Book "Optimechanikai Muszerek" Budapest, Muszaki Konyvklado, 1961 p 1–907
(FTD-TT-62-909/1+2+3+4; AD-440005)

Discussed are the basic optical concepts (light, lens, prisms) with contemporary instruments working on the basis of optical laws. Various shop, laboratory, and weather instruments suitable for the measurement of physical characteristics are also discussed. Principles of operation, characteristics, and fields of application are described. Emphasis is placed on the opticomechanical principle embodied in the instruments. I.v.L.

N64-22482* Yale U., New Haven, Conn.
MUON RESONANCE
Vernon W. Hughes Repr. from Low Symp. on Paramagnetic Resonance, Vol. I N.Y., Academic Press, 1963 p 381–396 refs
(Grant NsG-1-59)

The availability of polarized muons and the ability to detect the spin direction that is provided by parity nonconservation in the decays of the pi meson and the muon, have made possible magnetic resonance experiments on the muon, on muonium, and on mu-mesic atoms. The study of muon magnetism has advanced the knowledge of the properties of the muon, of relativistic and other higher order effects in atomic magnetism, including solid-state effects, and of nuclear structure. Author

N64-22491 Laboratoire de Physique Theorique et Des Hautes Energies, Orsay (France)
QUANTUM FIELD THEORY AND THE DYNAMICAL ROLE OF SPIN
Francois Lurçat May 1964 25 p refs
(TH-54)

The point of view currently taken in elementary particle physics, that the spin is an unessential complication and plays no dynamical role, is criticized. This assumption has no experimental ground; it is merely a consequence of the wave equations used, especially in field theory. To get rid of it, wave functions and fields as functions must be defined, not on Minkovski space, but on the Poincaré manifold. The result is a Poincaré field theory, for which the general features of field theory (relativistic invariance, locality, definition of free fields) are formulated. The spectral condition is only sketched. A physically important result is a generalized Kallén–Lehmann representation of the two-point function, where the spectral function depends on the mass and also on the spin. As a consequence, the peaks in this spectral function represent particles that may have different spin values and (when they are unstable) a spin spectrum, as well as a mass spectrum. The notion of Regge trajectory appears as a particular case. Author

N64-22524 J. G. Engineering Research Associates, Baltimore, Md.
FAR FIELD NOISE PREDICTION FROM NEAR FIELD SPECTRUM MEASUREMENTS
Joshua E. Greenspon Apr. 1963 9 p refs
(Contract Nonr-2733(00))
(TR-8; AD-410113)

A theory is presented for computing far-field noise radiation from near-field measurements. The relations are given for a spheroidal surface. It turns out that the same mathematical development in spheroidal functions can be used both for single frequency and for noise spectrum. Author

N64-22546 Naval Research Lab., Washington, D.C. Nuclear Reactions Branch
STOCHASTIC ESTIMATES OF THE PENETRATION OF GAMMA RAYS THROUGH SLAB SHIELDS
A. G. Pieper and L. A. Beach 26 Sep. 1963 35 p refs
(NRL-5981; AD-422646)

The energy penetration and dose-rate buildup factors were calculated by Monte Carlo techniques on a digital computer for a plane, monodirectional source of gamma rays of 1.0, 2.5, and 6.0 Mev incident at various angles upon finite slab shields of lead, iron, ordinary concrete, and water. The exponential transformation and equivalent integration over the spatial variable were utilized to obtain results for slabs up to 18 mean-free-pathlengths in thickness. A simple expression was derived that relates a given buildup factor at any incident angle to the corresponding buildup factor at normal incidence.
Author

N64-22612 Air Force Cambridge Research Labs., Bedford, Mass. Upper Atmosphere Physics Lab.
CHARGE TRANSFER STUDIES WITH A TIME-OF-FLIGHT MASS SPECTROMETER: II. KINETIC ANALYSIS, INCLUDING ATTENUATION OF BOTH NEUTRALS AND IONS BY SCATTERING Physical Sciences Research Papers No. 16
W. W. Hunt, Jr. May 1964 15 p refs
(AFCRL-64-383; AD-441461)

The kinetics of charge-transfer processes that occur in the drift tube of a time-of-flight mass spectrometer are analyzed, with due regard to attenuation of both ions and neutrals by scattering. The same equation that expresses the charge-transfer cross section in terms of experimentally measurable quantities provides for independent determination, from the same experimental measurements, of the difference between the total scattering cross section for the neutrals and that for the ions involved in the charge-transfer process being

studied. A second, and much simpler, equation for the charge-transfer cross section is used when the scattering cross sections for neutrals and ions are the same. Both equations allow for differences in detector response to neutrals compared with that to ions. Author

N64-22617 RAND Corp., Santa Monica, Calif.
A BASIC APPROACH TO THE USE OF CANONICAL VARIABLES AND VON ZEIPEL'S METHOD IN PERTURBATION THEORY
J. H. Hutcheson May 1964 49 p refs
(Contract AF 49(638)-700)
(RM-4074-PR; AD-600413)

This memorandum is concerned with the von Zeipel perturbation method for finding an approximate solution to differential equations such as occur in nonlinear mechanics. The method is illustrated by briefly introducing some fundamental principles of Hamilton–Jacobi mechanics relating to the formation of the Hamiltonian, canonic equations, canonic variables, transformations, etc. The von Zeipel method consists of making successive mathematical transformations of variables of a canonical system of differential equations. Two examples are worked out in detail—one for the nonlinear spring equation where energy is conserved and the other for the Van der Pol equation to illustrate how an energy-dissipating system is handled. Author

N64-22648 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EQUILIBRIUM OF A TOROIDAL PINCH IN A MAGNETIC FIELD
V. D. Shafranov 21 May 1963 22 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 13, no. 6, 1962 p 521–529
(FTD-TT-63-374/1+2+4; AD-409943)

The conditions of equilibrium of an axisymmetric toroidal pinch are obtained by analysis with respect to a/R (a and R—the small and large radius of torus) without concrete representation of the type of current distribution and of longitudinal magnetic field with respect to the pinch profile. It is assumed only, that in a zero approximation ($R = \infty$) the pinch has a cylindrical symmetry. Refined formulas are given for pinch displacement in a conducting housing suitable in the second approximation, i.e., taking into account terms of the order b^2/R^2, where b is the housing radius. Author

N64-22667 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PULSE-LAMP-PARAMETER DETERMINATION BY OBSERVATION OF NONLINEAR OPTICAL PHENOMENA
A. N. Rubinov and A. P. Ivanov 7 Apr. 1964 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk BSSR (USSR), v. 7, no. 8, 1963 p 524–527
(FTD-TT-64-153/1+2; AD-600582)

A method is described that will make it possible to determine the temperature and efficiency (coefficient of useful action) of a powerful source of light by the change in absorption capacity produced by it or by a change in the luminescence of the substance. J.L.D.

N64-22684 Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
THE PHOTOLYSIS OF NITRIC OXIDE
J. J. Mc Gee and Julian Heicklen 25 May 1964 16 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-105; TDR-269(4240-20)-3; AD-601470)

Electronically excited NO ($A^2\Sigma$) was produced by irradiation with the 2,144 and 2,265 A lines of the cadmium arc at nitric oxide pressures from 20 to 600 mm. The products were nitrogen and nitrogen dioxide. A pressure drop accompanied the reaction equivalent to the nitrogen produced. The mechanism is given. The quantum yield of nitrogen formation was independent of irradiation time and incident intensity. Its fall-off with pressure was less than a factor of two, even at 20 mm. These results, when combined with the radiative lifetime measurements of Callear and Smith, show that removal of NO ($A^2\Sigma$) occurs on nearly every collision. Author

N64-22717 Little (Arthur D.) Inc., Cambridge, Mass.
STUDY OF HIGH TEMPERATURE THERMODYNAMICS OF LIGHT METAL COMPOUNDS Progress Report No. 9, 1 Jan.–31 Mar. 1964
Alfred Büchler 31 Mar. 1964 10 p
(Contract DA-19-020-ORD-5584; ARPA Order 40-62, Amend. 16)
(C-64362; AD-440841)

A twin crucible system was constructed for increasing the reliability of comparing the mass spectra of pure LiF and of LiF in equilibrium with an LiF-BeF_2 melt. This crucible system permits the determination of the mass spectra of the vapors above a pure compound and a mixture in a single experiment. By comparing the mass spectra of pure LiF and pure BeF_2 with the mass spectra of LiF-BeF_2 melts, information concerning the activities of LiF and BeF_2 in the melts was obtained. The fragmentation patterns of mixed lithium–beryllium species ($LiBeF_3$ and Li_2BeF_4) were obtained. The mass spectrum of sodium nitrate at temperatures of a few hundred degrees was examined. Both $NaNO_3^+$ and $Na_2NO_3^+$ were found in the mass spectrum, showing the presence of $NaNO_3$ monomer and dimer in the vapor and confirming the alkali-halide-like nature of gaseous sodium nitrate. I.v.L.

N64-22724 Army Missile Command, Huntsville, Ala. Redstone Scientific Information Center
PHOTOELASTICITY: PURELY OPTICAL METHOD FOR DETERMINING DEFORMATIONS IN THICKNESS OF MODELS WITH PRACTICALLY NO RESTRICTIONS ON PARALLELISM OF SURFACES
V. Tesar 28 May 1964 13 p refs Transl. into ENGLISH from Rev. d'Optique Theorique et Instrumentale, no. 3, 1932 p 97–104
(RSIC-186; AD-441397)

A purely optical method for determination of the sum of principal stresses at all points in models used in photoelasticity studies is discussed. The method requires only medium smoothness of the surfaces and makes no requirements on parallelism of the surfaces. Included is a description of an experimental realization of the method. Author

24 PHYSICS, PLASMA

Includes fusion; and magnetohydrodynamics. *For related information see*: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N64-21622 Institute for Defense Analyses, Princeton, N.J. Jason Div.
BACKSCATTER OF ELECTROMAGNETIC RADIATION FROM A TURBULENT PLASMA

E. E. Salpeter and S. B. Treiman Dec. 1963 47 p refs
(Contracts ARPA-SD-50; AF 49(638)-1156)
(IDA-HQ-63-2024; P-55; AD-433907)

Any attempt at a quantitative description of the scattering of electromagnetic radiation from a turbulent plasma medium involves physical and mathematical approximations. The appropriateness of alternative approximation schemes is governed by a variety of parameters that characterize the radiation, the scattering geometry, and the structure of the plasma, e.g., the radar wavelength and angle-of-incidence, the mean-electron density, the correlation function for electron-density fluctuations, etc. A semiquantitative classification of the various regimes is presented, and corresponding approximation schemes appropriate for each are described and assessed. For a sufficiently underdense plasma a natural first estimate is represented by the Born approximation for scattering from turbulent eddies. Only the case of net radar scattering through very large angles, in fact, the cross section for back scattering, is discussed; collision damping is ignored. For every regime particular attention is devoted to the dependence of the back-scatter cross section on the angle-of-incidence of radar beam with respect to the surface of the plasma medium. Author

N64-21689 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France) Service de Physique des Plasmas
STATISTICAL PLASMA THEORY II. PART II: THE KINETIC EQUATION FOR A PLASMA Lecture Notes, Technical Note No. 5
G. Kalman (Technion, Israel) 1963 70 p refs
(Contract AF 61(052)-613)
(LP-29; ARL-64-44, Pt. II; AD-432427)

The topics discussed include the following: (1) the correlation function in equilibrium; (2) the kinetic equation; (3) derivation of an equation for the binary correlation function; (4) Bogoliubov's hypothesis; (5) the formal solution of the Liouville equation; (6) modification of the expansion coefficients; (7) the Vlasov and Fokker–Planck (Landau); (8) the kinetic equation for a plasma; and (9) the test-particle problem. R.T.K.

N64-21703 Arbeits- und Forschungsgemeinschaft Graf Zeppelin, Stuttgart (W. Germany)
PLASMA WIND TUNNELS AND PLASMA MECHANISMS [PLASMAWINDKANALE UND PLASMATRIEBWERKE]
T. Peters (Technische Hochschule München) [1963] 30 p Presented at the 60th Meeting on Aeronautics, Stuttgart-Vaihingen, 16 May 1963 In GERMAN

The development and state-of-the-art of electrothermal plasma propulsion are discussed. Emphasis is placed on the substitution of water-cooled, or tungsten, electrodes for the consumable electrodes. I.v.L.

N64-21709 Williamson Development Co., Inc., West Concord, Mass.
STUDIES AND INSTRUMENTATION FOR ACCELERATING PARTICLES IN A PLASMA Final Report
Joseph G. Kelley, Allen G. Rubin, and Ivan A. Nichols Bedford, Mass., AFCRL, 29 May 1964 29 p
(Contract AF 19(628)-309)
(AFCRL-64-412; AD-600761)

The plasma Betatron was designed, built, and operated as proposed. Suggestions are made for future modifications. Also discussed are transient optical measurements. An image converter camera was incorporated into the existing experiments. Infrared devices, particularly a laser interferometer, were designed. The 6-in. arc driven shock-tube facility is described. Significant modifications to the vacuum system and the high voltage system were completed. Various instrumentation problems are discussed. Presented are theoretical details for two experiments—the infrared interferometer and the plasma-conductivity measurement. Author

N64-21711 Bendix Corp., Southfield, Mich. Research Labs. Div.
DETERMINATION OF CHEMICAL SPECIES PREVALENT IN A PLASMA JET Technical Documentary Report, 1 Jun. 1961–31 May 1962
G. J. O' Halloran, R. A. Fluegge, J. F. Betts, and W. L. Everett Wright-Patterson AFB, AF Materials Lab., Apr. 1964 153 p refs
(Contract AF 33(616)-8374)
(AS-TDR-62-644, Pt.1; AD-600996)

A time-of-flight mass spectrometer and an optical spectrograph were modified to enable analyses of molecular, atomic, and ionic species obtained in similar and related plasmas at atmospheric pressure. Stabilized electric arcs of both argon and simulated air were analyzed in an attempt to understand the chemical, thermodynamic, and heat-transfer processes occurring therein. These experimental investigations produced both qualitative and quantitative data, but the optical equipment produced little useful information. Several sampling probes were designed, built, and tested. One of these, a supersonic probe design, was successfully used to perform plasma analyses at atmospheric pressure. Author

N64-21735 Princeton U., N.J. Plasma Physics Lab.
MEASUREMENT OF THE PERPENDICULAR TEMPERATURE OF THE C-STELLARATOR PLASMA BY THE DIAMAGNETIC COIL
Koji A. Uo Mar. 1964 66 p refs
(Contract AT(30-1)-1238)
(MATT-255)

This paper discusses: (1) the principle perpendicular temperature measurement deduced from the diamagnetic current signal when the spatial distribution of plasma is known; (2) the induced electromotive force due to the azimuthal component of the time-varying ohmic heating current considering the ohmic heating current density distribution in space; (3) the mutual inductance between the ohmic heating current column and the diamagnetic coil; (4) the eddy current effect of the stainless steel container of the confining field winding and the stainless steel vacuum vessel with ceramic break; and (5) the experimental procedure for obtaining the true diamagnetic signal and the comparison of the perpendicular temperature thus obtained to the resistivity temperature. N.E.A.

N64-21775 European Organization for Nuclear Research, Geneva (Switzerland) Accelerator Research Div.
SYNCHRONIZATION BETWEEN A 300 GeV SYNCHROTRON AND ITS BOOSTER INJECTOR
L. Resegotti and W. Schnell 23 Apr. 1964 36 p refs
(CERN-64-20)

The problem of beam transfer from a synchrotron injector to a large synchrotron, in particular the transfer of the beam from the one RF system to the other, is discussed. A nonadiabatic and rapid method for obtaining the transfer is proposed and discussed. In addition, other possible methods are briefly discussed, and some relations of general validity are derived. P.V.E.

N64-21797 Stanford Research Inst., Menlo Park, Calif.
THE ROLE OF ALUMINUM AND ITS OXIDES AS SOURCES OR MODERATORS OF ELECTRONS IN SOLID PROPELLANT ROCKET EXHAUSTS

G. Neil Spokes [1963] 51 p refs
(Contract AF 04(694)-128)
(QSR-6; AD-434699)

Evidence is presented for the occurrence of reactions that liberate ions from surfaces. The ions that have thus been ejected from a wall in an atmosphere of active nitrogen include NO^+, N, N_2^+, N_3^+, and N_4^+. Surface chemionization reactions of this kind could be important in the production of excess ionization in rocket exhausts. A model is given for the propagation of electromagnetic waves through gas-particle plasmas. A more refined approach for the theoretical study of electron distributions about particles that emit thermionic electrons was adopted. Some preliminary results are given. Other work on the subject is examined and corrections suggested. Author

N64-21823 Stevens Inst. of Tech., Hoboken, N.J.
EARLY-TIME COLLECTIVE EFFECTS IN A PLASMA BETATRON
S. J. Lukasik and K. C. Rogers [1963] 47 p refs
(Contract DA-36-039-SC-87242; ARPA Order 112-62)
(SIT-114; AD-434423)

Electrostatic collective effects occurring during startup have been examined numerically in a simple model of a plasma betatron having a uniform guide field, vector potential $A_\phi(r,t) = 0.5\ B_0\ [r + 1.3\ r_1^2/r]\ \sin \omega t$. A region in the neighborhood of the equilibrium orbit, populated by an initially uniform zero temperature distribution of electrons and infinitely heavy ions, was divided into cells. The trajectory of each particle of a cell was taken to be that of the central particle. The electrostatic force acting on a particle during a time step was calculated from the charge distribution obtained at the end of the preceding time step. Typical values of parameters were: electron density $10_9 \leq n \leq 10^{12}$ cm $^{-3}$, $B_0 = 50$ kilogauss, $\omega = 10^8$ sec^{-1}, and $r_1 = 5$ cm. Author

N64-21971 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ROLE OF ION VELOCITY DURING THE EXCITATION OF PLASMA OSCILLATIONS BY AN ION BEAM
M. D. Gabevich and G. S. Kirichenko 19 Mar. 1964 8 p Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, no. 6, 1963 p 624–627
(FTD-TT-64-115/1+2; AD-435510)

Theory predicts that when an ion beam passes through plasma, excitation of the plasma oscillations may occur, but at a sufficiently higher ion energy the system should be stable at any ratio of ion beam–plasma concentration. Experiments were conducted in which observations were made of the excitation of plasma oscillation by a beam of slow ions and of the disappearance of these oscillations upon an increase in the ion energy values. The observations appear to furnish a qualitative confirmation of the theory. I.v.L.

N64-21977 Air Force Systems Command, Wirght-Patterson AFB, Ohio Foreign Technology Div.
ON THE UTILIZATION OF A HIGH PULSE DISCHARGE IN PHOTON SOURCES
M. D. Gabovich, O. F. Nemets et al 24 Apr. 1964 13 p refs Transl. into ENGLISH from Ukr. Fiz. Zhurnal (Kiev), v. 3, no. 1, 1958 p 104–111
(FTD-TT-64-330/1+2; AD-600586)

A powerful pulsed arc, originating during the transition from the Penning to the Keller type discharge, was investigated as a possible pulsed ion source. At discharge currents of up to 200 amp the extracted ion currents exceed 30 ma, and the density of the extracted ion current in the outlet opening exceeds 4 amp/cm^2. It was shown that, in spite of the difficulties encountered, the obtainment or reproducible ion pulses of rectangular form and low modulation is possible. The growth of the proton content with the rise of the discharge current of the arc was established, and reached 85% to 90% under conditions of a metallic chamber. The device was used for pulsed entry of hydrogen. Author

N64-21978 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE CRITICAL EFFECT OF GEOMETRIC DIMENSIONS OF EXTRACTION SYSTEMS OF A HIGH FREQUENCY PROTON SOURCE ON THE CURRENT INTENSITY OF ION BEAM
M. D. Gabovich and G. N. Pyankov 23 Apr. 1964 6 p refs Transl. into ENGLISH from Ukr. Fiz. Zhurnal (Kiev), v. 3, no. 3, 1958 p 419–420
(FTD-TT-64-331/1+2; AD-440937)

A system was proposed for exciting a discharge in a high frequency proton source, which would allow, at constant power, raising both the intensity of the ion stream near the outlet channel and also the magnitude of the current of the ion beam. This system differs from others in that the resistance magnetic field is rectified along the axis of ion extraction and the axis of the high frequency circuit coil is perpendicular to that axis. Investigations to explain the effect of the geometry of the extracting system on the current intensity of the ion beam indicate the possibility of a critical effect of the diameter (d) of the diaphragm on the extraction of ions. M.P.G.

N64-21979 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PENETRATION OF PLASMA FROM A SOURCE WITH ELECTRON OSCILLATIONS TO AN EVACUATED REGION WITH A MAGNETIC FIELD
M. D. Gabovich, L. I. Romanyuk et al 11 May 1964 15 p refs Transl. into ENGLISH from Zhurnal Tekhn. Fiz. (Leningrad), v. 34, no. 3, 1964 p 488–495
(FTD-TT-64-400/1+2+4; AD-600510)

Discussed is an investigation of a plasma, from an ion source with electron oscillations, penetrating into an evacuated region located in a relatively strong uniform magnetic field. A lanthanum hexaboride pellet, 6 mm in diameter and heated by a tungsten coil, served as a cathode. A water-cooled copper cylinder served as the anode. The electron reflector, that usually is at cathode potential, was a copper electrode having a 3-mm-diameter aperture for plasma discharge. The plasma was discharged through the aperture into the evacuated region inside a glass cylinder. The investigation is divided into the following divisions: (1) penetrating plasma—spatial distribution of potential; (2) energy of the ions emitted into an evacuated region; and (3) static probe potential—fast electrons. P.V.E.

N64-21989 University of Southern Calif., Los Angeles School of Engineering
SOME NONLINEAR PROBLEMS IN PARTIALLY IONIZED GASES
E. C. Du Fort Jun. 1964 251 p refs
(Contract AF 19(604)-6195)
(USCEC-82-217; EE-37; AFCRL-64-388; AD-601133)

A theoretical study of the harmonics arising from nonlinear dissipation is discussed as follows: (1) the kinetic theory of plasmas; (2) the development of accurate nonlinear macroscopic equations linking the important average quantities (current, electron temperature, etc.) together; and (3) the application of the macroscopic equations to nonlinear problems

involving harmonics. The literature is reviewed. The macroscopic equations for the plasma and simple equations for the electron current and electron temperature are developed directly from the kinetic theory. The macroscopic approach is applied to two nonlinear problems. The first is a study of the low-frequency nonlinear current flow associated with the monochromatic electric field of arbitrary intensity. In the second nonlinear problem, a monochromatic field is incident upon a semiinfinite plasma slab, and the back radiation from the interface and the nature of the field within the plasma are sought. P.V.E.

N64-22006 Nagoya U., (Japan) Inst. of Plasma Physics
MICROWAVE RADIATION AT CYCLOTRON HARMONICS IN A POSITIVE COLUMN
Shigetoshi Tanaka and Hiroshi Kubo (Kyoto U.) Feb. 1964 37 p refs Submitted for Publication
(IPPJ-RR-23)

The microwave emission of electron cyclotron harmonics is measured on a positive column in arc discharge. The number of successive harmonics observed and their respective amplitudes increase with decreasing gas pressure. The highest harmonics number observed (N_{max}) is determined by the magnitude of the collision frequency between electron and neutral particles. $N_{max} = 2$ in the high-pressure discharge of neon ($p = 7.8$ torr) and $N_{max} = 15$ in the low-pressure discharge of mercury vapor ($p = 2.6 \times 10^{-3}$ torr). As the gas pressure decreases, N_{max} measured on the plasma when the whole discharge tube is immersed in the magnetic field, is larger than that, when a part of positive column is placed in the field. The peculiar resonant peaks are observed in the vicinity of the 2nd, 3rd, and 4th harmonics. Author

N64-22029 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE ADIABATIC INVARIANTS OF MOTION OF A CHARGED PARTICLE IN A STATIONARY HETEROGENEOUS MAGNETIC FIELD
V. D. Plemnex and G. A. Skuridin *In its* Cosmic Res. 14 Feb. 1964 p 80–109 refs (See N64-22027 15-29)

On the basis of the classical theory of adiabatic invariants, conditions are examined for conserving the first, second, and third invariants of the motion of a charged particle in a spatial magnetic system. Since such a motion of a particle in a magnetic field is not strictly conditionally periodic, theoretically there can be a divergence of the adiabatic approximation related to the inseparability of variables in the Hamilton–Jacobi equation. The problem is raised concerning estimation of the accuracies of conserving the second and third invariants in a stationary magnetic field. Author

N64-22031 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MOTION OF CHARGED PARTICLES IN A MAGNETIC DIPOLE FIELD WITH ALLOWANCE FOR DISSIPATION OF ENERGY
V. M. Vakhnin, G. A. Skuridin, and I. N. Shvachunov *In its* Cosmic Res. 14 Feb. 1964 p 128–162 refs (See N64-22027 15-29)

The problem of the motion of charged particles in a magnetic field is considered in a conservative approximation, and an allowance is made for dissipative perturbation for the following three idealized systems: (1) a magnetic dipole field in the absence of an outer magnetic field; (2) a magnetic dipole in a space having a homogeneous magnetic field parallel to the magnetic dipole field strength vector in its equatorial plane; and (3) a magnetic dipole in a space with a homogeneous magnetic field antiparallel to the magnetic dipole field strength vector in the equatorial plane. Author

N64-22054 General Motors Corp., Indianapolis, Ind. Allison Div.
REPETITIVE PULSED ACCELERATION OF PLASMAS DERIVED FROM EXPLODING METAL FILMS
T. L. Rosebrock, D. L. Clingman, and D. G. Gubbins [1963] 37 p refs

A unique, repetitively pulsed, plasma accelerator that uses thin metal films as plasma sources is described. The unique features of the unit are the quasi-planar thin film propellant, which is stored in solid bulk form, and the vapor deposition technique by which it is introduced into the accelerator. The concept evolved as a result of a 3-year study of plasma accelerators that employed exploding metal wires as plasma sources. Performance deficiencies revealed by the study were largely overcome by the present device. Prior to the construction of the accelerator, experiments were performed that demonstrated proof-of-principle for each of its components. These experiments are described, together with material requirements for the complete accelerator package. Author

N64-22065* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
THEORETICAL CURRENT-VOLTAGE CURVE IN LOW-PRESSURE CESIUM DIODE FOR ELECTRON-RICH EMISSION
C. M. Goldstein Repr. from J. Appl. Phys., v. 35, no. 3 (Pt. I), Mar. 1964 p 728–729 refs
(NASA-RP-185)

A theoretical current-voltage curve is presented for a low-pressure cesium diode for electron-rich emission. The model employed is defined by the limiting potential distributions. Although solutions for infinitely spaced electrodes show that spatially oscillatory potential distributions may exist, they have been neglected in this computation. J.R.C.

N64-22070* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
SPECTROSCOPIC DETERMINATION OF ELECTRON TEMPERATURE AND PERCENTAGE IONIZATION IN A HELIUM PLASMA
Ronald J. Sovie Repr. from Phys. Fluids, v. 7, no. 4, Apr. 1964 2 p refs
(NASA-RP-195)

The electron temperature and the percentage ionization in a low-pressure, high-temperature tenuous plasma were determined. The method employed utilizes the observed excitation cross sections for certain helium singlet and triplet spectral lines that are known over a range of electron energies. These cross sections are then averaged over a Maxwellian distribution of the electron velocity. From the ratio of these averaged cross sections, the intensity ratio is plotted as a function of the electron kinetic temperature. Methods of determining the percentage ionization are discussed, and sources of errors are mentioned. IAA

N64-22089 Unified Science Associates, Inc., Pasadena, Calif.
STABLE DENSE COLD PLASMA Semiannual Technical Summary Report, Period Ending 20 Feb. 1964
S. Naiditch 31 Mar. 1964 11 p
(Contract Nonr-3437(00); ARPA Order 194)
(AD-434265)

Activities in the dense cold gaseous plasma program have centered around two aspects, the preparation of gaseous plasmas of higher electron densities and the measurement of

electron concentrations in both the liquid and gaseous states. The ammonia purification system was modified to improve the purity of the ammonia and to ease the preparation of the sodium-ammonia solution. Electrical conductivity measurements were extended to concentrated solutions in an attempt to produce gaseous plasmas with much higher conductivity. Studies of the effects of pressure on conductivity at constant temperature were initiated. Measurement of the Hall effect in sodium-ammonia solutions was begun as an independent method of determining electron densities and mobilities.
D.S.G.

N64-22109 Princeton U., N.J. Plasma Physics Lab.
ON CLASSICAL AND ENHANCED DIFFUSION IN CESIUM AND POTASSIUM PLASMAS
N. Rynn Apr. 1964 13 p refs
(Contract AT(30-1)-1238)
(MATT-259)

Investigation revealed that the passage of a current through plasma had a large effect upon the diffusion rate. Diffusion processes under conditions of no current are compared with those of instability. (A potential is applied and the longitudinal current is increased from zero until a critical point is reached at which the volt-amperes characteristic suddenly changes, and there is a sudden onset of instability.) It was shown that an attempt to fit the unstable case to the classical diffusion theory is unsuccessful, as it should be for consistency.
N.E.A.

N64-22125 Aerospace Corp., El Segundo, Calif.
SOME OBSERVATIONS OF PLASMA TURBULENCE
R. Betchov, R. C. Phillips, and E. B. Turner 24 Apr. 1964 23 p refs
(ATN-64-(9231)-3)

The random fluctuations of the magnetic field during a linear pinch have been observed in detail. Under given conditions, the fluctuations are statistically reproducible. However, the fluctuations have a complicated geometry, and certain asymmetries remain unexplained. It appears that the current sheath is preceded by a shock wave as seen in a space time-chart description. Magnetic fluctuations have been observed from 1 mc up to 50 mc, which is the cutoff frequency of the probes. Examples of correlation are given, as well as double probe signals obtained with two coils in a single quartz tube. It was observed that, after a long rest, the first discharge did not show turbulence. This points out the importance of the wall conditions.
Author

N64-22140 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
REACTION OF He^3 With Deuterons
A. P. Klyucharev, A. K. Val'ter, and B. N. Yesel'son 14 Apr. 1964 9 p refs Transl. into ENGLISH from Tr. Sessii AS Ukr SSR po Mirn. Ispol'zovaniyu Atomn. Energii (Kiev) 1958 p 64–69
(FTD-TT-63-991/1+2; AD-600605)

In this experiment, the cross section He (d,p)He reactions in the zone of energies of bombarding neutrons 100 to 1,500 kev by the registration of alpha particles was investigated. The measured results confirm the discovery of resonance process of He^3 (d,p)He^4 reactions with position of the resonance maximum at a deuteron energy, equaling 435+30 kev. The magnitude of the differential cross section in the maximum is 63.4 millibarn/steradians (barn = $10^{-24}cm^2$), and drops monotonously to a value of 11 millibarn/sterdians at an energy of 1,500 kev. The error in determining this value is estimated to be ± 7%.
N.E.A.

N64-22161 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF COULOMB INTERACTION OF ELECTRONS WITH IONS ON THE OPTIMUM COMPOSITION OF A GASEOUS MIXTURE
E. P. Zimin and V. A. Popov 11 May 1964 7 p Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 4, 1963 p 112–114
(FTD-TT-64-441/1+2+4; AD-600607)

This paper discusses the optimum composition for a mixture of a practically nonionized gas with an easily ionizable gas. This state corresponds to maximum electrical conductivity and is defined by a given mathematical expression. The article treats the relationship of electrical conductivity with the Coulomb interaction of electrons with ions within the mixture, and shows the conductivity to be a function of the relative partial pressure and temperature.
C.L.W.

N64-22209 Cincinnati U., Ohio
AN EXPERIMENTAL STUDY OF THE EFFECT OF AN ELECTRIC FIELD ON THE SHARP GREEN FLUORESCENCE TRANSITIONS OF E R IV IN SINGLE CRYSTALLINE FLUORITE
Perry Pappas Yaney Wright-Patterson AFB, Ohio, RTD, Jan. 1964 72 p refs
(Contract AF 33(616)-7450)
(RTD-TDR-63-4017; AD-434795)

An investigation of the strong, green fluorescence spectra of CaF_2 dilutely doped with Er^{3+} was made at 77° and 4.2° K. The spectra were found to arise from $E(^4S_{3/4})$ to $Z(^4I_{15/2})$ transitions in three nonequivalent sites. The sites were identified as of cubic symmetry, of trigonally distorted cubic symmetry, and of tetragonally distorted cubic symmetry. Crystal field splitting schemes are proposed for each site. The ratio of the 6^{th} order to 4^{th} order potentials of the cubic crystal field is estimated to be −0.13. The relative shifts in the wavelengths of the sharp transitions to the low-lying levels of the ground state versus the intensity of a static, uniform, externally applied electric field were measured in the cubic sites at 77° and 4.2° K and in the trigonally distorted sites at 4.2° K. The measurements were made using three crystals with the field parallel to one of the ⟨100⟩, ⟨110⟩, and ⟨111⟩ directions of the crystal, respectively, and with applied fields up to 160 kv/cm.
Author

N64-22217 Naval Research Lab., Washington, D.C. Radiation Div.
A STUDY OF RADIATION INDUCED SHOCK WAVES EXTERNAL TO QUARTZ DISCHARGE TUBES AND ASSOCIATED FRACTURE PROBLEMS
R. C. Elton 30 Mar. 1964 11 p refs
(NRL-MR-1509; AD-434325)

The large amount of radiant energy emitted in the ultraviolet spectral region from ~2 ev plasma in a fused quartz T-tube suggested that the absorption of this radiation might be responsible for initiating the external shock wave and shattering the tube. It was concluded that the oxygen component in air was the primary absorbing gas. All attempts to coat the surface with a high reflecting layer failed, owing to damage from the intense radiation. A satisfactory solution involved the use of reflecting, low conductivity, stainless-steel strips attached to the tube with a fiber glass base tape. Investigation of the mechanisms involved indicated that there is an impulse driven implosion, and that a catalytic mechanism supplied by the hot plasma is necessary, in addition to the external shock wave, to effect the observed shatter.
D.S.G.

N64-22226 Harvard Coll. Observatory, Cambridge, Mass. Shock Tube Spectroscopy Lab.
[DESIGN AND CONSTRUCTION OF A NEW SHOCK TUBE AND EXPERIMENTAL MEASUREMENT OF TEMPERATURES AND OSCILLATOR STRENGTHS] Annual Report, 1963
W. H. Parkinson and E. M. Reeves [1964] 10 p refs
(Contract Nonr-1866(48))
(AD-433547)

The temperature measurements have shown that the hot shocked gas is in thermodynamic equilibrium and that the temperature can be accurately measured with the intensity–emissivity technique. This is of great importance in developing a shock tube to measure oscillator strengths. The technique described for measuring wide autoionized lines will also be used to measure the f-number of the aluminum ionization continuum. These measurements will be extended to other suitable atoms. N.E.A.

N64-22239 Lincoln Lab., Mass. Inst. of Tech., Lexington
ELECTROMAGNETIC BACKSCATTERING CROSS SECTION OF A CIRCULAR CYLINDRICAL SECTION
S. L. Borison 18 Feb. 1964 35 p refs *Its* Group Report 1964-14
(Contract AF 19(628)-500; ARPA Order 498; Proj. Defender)
(ESD-TDR-64-36; AD-433714)

The electromagnetic backscattering cross section of a perfectly conducting circular cylindrical section is expressed in the Kirchoff approximation. The cross section for incidence at an arbitrary angle in either a longitudinal or a transverse plane is related to a geometrical structure integral. Using methods of contour deformation, this integral is approximated for the case of large linear dimensions compared to the incident wavelength. Comparison of the cross section with that of the equivalent flat plate (equal aperture) indicates that the central lobe of the flat plate is reduced by the factor $1/8\ (R/\lambda)\ \sin^2 \psi_m$; however, the angular width in the transverse plane is increased to approximately $2\psi_m \times (R$ = radius of curvature; ψ_m = aperture half-angle). Typical values of R and ψ_m are chosen for calculation, and the results are presented pictorially.
Author

N64-22275 Hallicrafters Co., Chicago, Ill.
INFORMATION TRANSFER FUNCTIONS THROUGH PLASMAS Final Report
Griffiss AFB, N.Y., RADC, Apr. 1964 136 p refs
(Contract AF 30(602)-3069)
(RADC-TDR-63-548; AD-441582)

The degradation in information content undergone by surveillance and communication signals transmitted through the plasma sheath has been calculated for some specific reentry conditions. A comparative analysis has been made for all present day types of modulations assuming a flush-mounted slot antenna located near the stagnation point of the reentry vehicle and operating near, but above, the plasma frequency. The analysis is based on a transfer function that relates the space–time Fourier transforms of the antenna exciting field to the received radiation field. The end results, presented graphically in terms of both error probability and transinformation vs input signal-to-noise ratio, are based on the calculated pulse distortion undergone by the signal as it traverses the plasma sheath. The results of this study point out that for the plasma model under consideration the performance of all modulated signals is degraded, with the greatest degradation occurring for amplitude keying and the least degradation occurring for phase shift keying. Author

N64-22298 ARO, Inc., Arnold Air Force Station, Tenn.
CHARTS OF NORMAL SHOCK WAVE PROPERTIES IN IMPERFECT NITROGEN
Clark H. Lewis and E. G. Burgess, III Arnold Eng. Develop. Center, May 1964 54 p refs
(Contract AF 40(600)-1000)
(AEDC-TDR-64-104; AD-600844)

Gas-dynamic properties, which include the effects of dissociation, ionization, and intermolecular forces (van der Walls), are presented for incident and reflected shock waves in equilibrium imperfect nitrogen. Charts are presented for incident shock Mach numbers ranging from 4 to 30 into (ideal) nitrogen at a temperature of 300° K and pressures ranging from 10^{-4} to 10^3-cm Hg. The temperature and density in any region do not exceed, respectively, 15,000° K and 150 amagats. In addition to the usual incident and reflected shock properties, stagnation conditions upstream and downstream and conditions immediately downstream of a standing shock wave are also presented. At pressures above 1 atm in the undisturbed gas, the effects of the intermolecular forces on the gas-dynamic properties are demonstrated. Author

N64-22306 Electro-Optical Systems, Inc., Pasadena, Calif.
BASIC RESEARCH ON GAS FLOWS THROUGH ELECTRIC ARCS-HOT GAS CONTAINMENT LIMITS
G. L. Cann, R. D. Buhler, R. L. Harder, and R. A. Moore Wright-Patterson AFB, Ohio, ARL, Mar. 1964 65 p refs
(Contract AF 33(657)-7940)
(ARL-64-49; AD-600798)

Extensive measurements in a cascade-type arc research apparatus were carried out with hydrogen, helium, ammonia, and argon, covering both the inlet region and the fully developed region of the coaxial flow discharge. The inlet (gas heater) region results for three gases were compared with the Stine–Watson first-order theory. For the size–pressure regime in which radiation can be neglected, the Stine–Watson relations with empirically adjusted constants gave a satisfactory semiempirical description of all the inlet cases investigated. To estimate the ultimate technical limits of arc gas heater performance, the approximate theories for the fully developed arc column (Parabola and Bessel Models) were extended to include radiation and (for the high current regime) the self-magnetic pressure gradient. Hot-gas containment limits (highest radially-averaged outlet enthalpy vs pressure) were calculated for air, for a range of allowable wall heat loads (0.1-10 kw/cm^2). This resulted in a predicted absolute technical limit of continuous hot-gas containment independent of size, within the pressure–size range of the optically thin gas approximation. Author

N64-22313 Michigan U., Ann Arbor
HEATING AND IONIZATION OF A GAS STREAM BY REPETITIVE, SUPPRESSED-BREAKDOWN DISCHARGES Final Technical Report
H. C. Early and F. J. Martin Wright-Patterson AFB, Ohio, ARL, Mar. 1964 29 p
(Contract AF 33(616)-7243)
(ARL-64-43; AD-601048)

When an impulse voltage having a very fast rise time is applied to corona-type electrodes, a current of several thousand amperes may flow through the gas before appreciable spark-streamer formation takes place. If the voltage is quickly removed, several joules of energy can be delivered to an atmospheric-density gas in a single suppressed-breakdown pulse. By using pulse repetition rates of several thousand per second, many kilowatts of electrical power can be delivered to a subsonic or supersonic gas stream by a single set of electrodes.

Compared to arc-heating methods, the pulsed-corona discharge is diffuse and uniform and the gas flow remains much more homogeneous. Author

N64-22327 Michigan U., Ann Arbor Electron Physics Lab.
ENHANCEMENT OF PLASMA DENSITY IN AN ARC DISCHARGE
A. Singh and J. E. Rowe Feb. 1964 32 p refs
(Contract AF 33(657)-8050)
(TR-64; AD-600542)

The use of an electron beam–plasma interaction scheme for the generation and/or amplification of coherent signals in the millimeter wavelength regime requires the creation of a high-density stable plasma. A plasma density of approximately 10^{15} particles/cm^3 is required to produce a plasma resonance frequency of 300 Gc. The density in an arc discharge plasma has been increased using mechanical and magnetic constriction methods. A density of 7.5×10^{14} particles/cm^3 is realized at a discharge current of 4 amperes in argon. Double Langmuir probe measurements of density and temperature in the plasma are presented for zero and finite magnetic field conditions. Author

N64-22337 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTRIBUTION TO THE PROBLEM OF THE EFFECT OF THE ATMOSPHERE ON THE RADIATION OF AN ARC DISCHARGE (2nd INSTALLMENT)
O. P. Semenova and M. V. Petrova 11 Mar. 1963 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 1, 1962 p 111–117
(FTD-TT-63-19/1+2; AD-401594)

The effect of various atmospheres (air, nitrogen, and argon) on the radiation of an arc discharge was investigated using carbon electrodes, ISP-28 and ISP-51 spectrographs, and an UF-84 camera. The following are indicated by the results: (1) The structural distribution of the radiation across the discharge in an arc between carbon electrodes in an atmosphere on argon apparently must be attributed to a unique distribution of the temperature over the section of discharge. The change from an atmosphere of air to one of nitrogen, and far more for air to argon, is equivalent to transition to a discharge at a lower pressure. (2) The substitution of one atmosphere for another, in a low-current discharge, is reflected in the radiation of the arc discharge through a change in the entrance of vapors of the electrodes into the discharge and in effective sections of scattering of electrons by the arc gas. Also, similar investigations with iron and copper electrodes are discussed. I.v.L.

N64-22367* Denver U., Colo.
RESONANT EXCITATION IN HELIUM ION-ATOM COLLISIONS
Nyle G. Utterback Repr. from Phys. Rev. Letters, v. 12, no. 11, 16 Mar. 1964 4 p refs
(Grant NsG-392)

Curves are presented of the ionization cross sections measured for He–H_2 and H_2–He as well as for the difference between He–H_2 and H_2–He cross sections. The hypothesis that the neutral helium beam contained a metastable component is proposed as giving a consistent and satisfactory explanation for the difference in the He–H_2 and H_2–He curves. Consistency checks were made of the hypothesis by investigating the ionization cross section for He–Ne^5 and He–Ar. R.T.K.

N64-22369 Microwave Associates, Inc., Burlington, Mass.
HIGH POWER BEAM-PLASMA AMPLIFIER Fourth Quarterly Progress Report, 15 Sep.–14 Dec. 1963
M. A. Allen, C. S. Biechler, P. Chorney, and H. S. Maddix [1964] 87 p refs
(Contract DA-36-039-AMC-00076(E); Proj. Defender; ARPA Order-331-62)
(Rept.-4; AD-433590)

Results from the large signal computer theory are given for cases that closely correspond to the first amplifier. The low pressure plasma generation problem is discussed, and experimental results are presented. Experiments conducted on two direct plasma coupling schemes are discussed. Author

N64-22400 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PROBLEM OF CONTROLLED THERMONUCLEAR SYNTHESIS
L. A. Artsimovich 1 Mar. 1963 19 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), no. 1, 1962 p 7–15
(FTD-TT-62-1788/1+2; AD-299853)

A brief survey is presented of the results of research carried out to determine ways of retaining a dense, high-temperature plasma for relatively long periods of time. P.V.E.

N64-22404 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVARIANT GROUP SOLUTIONS OF THE EQUATIONS OF A PLANAR STATIONARY BEAM OF CHARGED PARTICLES
V. A. Syrovoy 5 Feb. 1963 23 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 4, 1962 p 10–20
(FTD-TT-62-1810/1+2+4; AD-299674)

The concept of self-similar solutions is used in various branches of physics. A wide class of self-similar solutions has been investigated with the aid of dimensionality theory. The concept of invariant group solutions was introduced, and a general method of obtaining them was developed. This method was used to investigate a nonlinear heat-conduction equation. Subsequently, invariant group solutions of the equations of motion of a viscous incompressible fluid and of an incompressible boundary layer in the plane case were examined. Investigated are the group properties of the equations of a beam in the absence of an external magnetic field and in a given external magnetic field. Author

N64-22408 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF THE OPTIMUM COMPOSITION OF GASEOUS MIXTURES CONTAINING AN EASILY IONIZABLE ADDITIVE
E. P. Zimin and V. A. Popov 8 Feb. 1963 12 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 3, 1962 p 10–14
(FTD-TT-62-1893/1+2+4; AD-299633)

By diluting the vapor of easily ionizable metals with practically nonionizable gases, mixtures whose conductivity at a given temperature and pressure is higher than that of the vapor of the pure metal are created. The conductivity of such mixtures is not very much greater than the conductivity of the pure metal, but there can be a large saving of metal. The use of such a dilution is limited with respect to temperature and pressure. N.E.A.

N64-22409 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A MAGNETIC TRAP FOR COLLIDING BEAMS

Zh. S. Takibayev 7 Mar. 1963 15 p refs Transl. into ENGLISH from Fizika Chastits Vysokikh Energiy. Struktura Yadra., Tr. Inst. Yadern. Fiz. Akad. Nauk Kaz. SSR (USSR), v. 5, 1962 p 147–154
(FTD-TT-62-1901/1+2+4; AD-299620)

The question of using oppositely moving beams of deuterons and tritons for obtaining sufficiently intense nuclear synthesis reactions is considered. The possibility of confining such beams with the aid of a magnetic field of a particular configuration is discussed. Author

N64-22423* Maryland U., College Park
SHOCK TUBE SPECTROSCOPY: REVIEW AND RECENT RESULTS
G. Charatis and T. D. Wilkerson [1963] 18 p refs Proc. of the 6th Intern. Conf. on Ionization Phenomena in Gases, Vol. III, S.E.R.M.A., Paris, France, Jul. 1963
(Grant NsG-359)
(NASA-CR-56473)

Conventional shock tubes are used in the temperature range 5,000° to 15,000° K for measuring atomic transition probabilities (oscillator strengths). Reduction of line intensities to atomic constants proceeds via knowledge of gas conditions. Results for Cr I and Cr II lines are discussed, based on experiments in the Michigan shock tube. Experience with this instrument is reviewed regarding measured pressures, temperatures, and flow durations. Properties of the new Maryland shock tube give greater flexibility for spectroscopic work. An improved flash lamp allows temperature measurements at least up to 15,000° K by means of spectral line reversal. Author

N64-22444* Electro-Optical Systems, Inc., Pasadena, Calif.
SURFACE IONIZATION STUDIES Final Report, 11 Jul. 1963–10 Jan. 1964
W. D. Dong, D. G. Worden, and D. Zuccaro 11 Jun. 1964 44 p refs
(Contract NAS3-2592)
(NASA-CR-54047; EOS-4070-Final)

Tungsten, rhenium, and niobium were investigated to determine their surface ionization efficiencies for cesium, and to study the influence of adsorbed gases on the surface ionization of cesium. Cesium ion currents from wire samples of tungsten, rhenium, and niobium were measured as functions of wire temperatures and incident neutral cesium flux rates. The experiments were performed with a cesium atomic beam apparatus. Author

N64-22471* Massachusetts Inst. of Tech., Cambridge Lab. for Nuclear Science
PRELIMINARY RESULTS OF PLASMA MEASUREMENTS ON IMP-A
H. Bridge, A. Egidi, A. Lazarus, E. Lyon, and L. Jacobson (Lincoln Lab.) [1964] 19 p refs Presented at the COSPAR Conf., Florence, Italy, May 1964
(Grant NsG-386)
(NASA-CR-56294) OTS: $1.60 ph

Preliminary IMP-A plasma measurements made with a Faraday-cup-type instrument are presented. The main results are as follows: (1) A directed flux of positive plasma ions is always observed in regions beyond the influence of the earth. (2) On each satellite pass two transitions in the plasma properties are usually observed; one transition can be identified with the magnetopause and one with a shock front created by the supersonic plasma stream. At the subsolar point, 12:00 hr, typical geocentric distances to these regions are $10R_e$ and $14R_e$, respectively; on the dawn side of the magnetosphere, 06:00 hr, the corresponding distances are $14R_e$ and $23R_e$. (3) In the transition region between the shock and the magnetopause a hot isotropic flux of positive plasma ions is observed. Author

N64-22490* North Carolina State Coll., Raleigh
ON THE STRESS TENSOR OF A PARTIALLY IONIZED GAS IN THE PRESENCE OF ELECTRIC AND MAGNETIC FIELDS
H. A. Hassan Repr. from Plasma Phys. (J. of Nucl. Energy Part C), v. 6, 1964 p 289–293 refs
(Grant NsG-363)

Explicit expressions for the stress tensors of the constituents of a partially ionized gas and the overall stress tensor are presented. The derivation is based on Burgers' transfer equations and takes into consideration the presence of electric and magnetic fields. The results include, as a limiting case, the results of Burgers and Herdan and Liley for the fully ionized case. Author

N64-22561 Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
A STUDY OF ARTIFICIAL DIELECTRICS
Kurt E. Golden 15 May 1964 72 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-90; TDR-269(4280-10)-4; AD-601325)

The simulation of a plasma sheath using an artificial dielectric is studied in this investigation and is applied to an antenna geometry similar to some configurations encountered in aerospace applications. The antenna configuration is equivalent to a horn in an infinite ground plane with an unbounded plasma layer in front of the horn. The plasma layer is simulated by a rodded medium, and the radiation patterns of the antenna system are studied experimentally at 9, 10, and 11 kmc. The characteristics of a rodded medium are obtained both theoretically and experimentally. A rodded medium not only simulates the isotropic characteristics of a plasma sheath but also the anisotropic characteristics of a plasma in an infinite steady magnetic field. If the rods are oriented in one direction, the equivalent tensor permittivity of the rodded medium is in the same form as the tensor permittivity of a cold plasma in a very strong magnetostatic field. The theoretical analysis is based on the geometrical symmetries of the medium and the transmission line approach to propagation in an artificial dielectric of periodically spaced conducting obstacles. The anisotropic characteristics of a rodded medium are demonstrated in X-band waveguide measurements. Two constructions of rodded media are utilized in the pattern measurements. The experimentally determined radiation patterns seem to have a secondary maximum associated with the properties of the plasma sheath. More energy is radiated in the off-axis region when the plasma sheath is present. Author

N64-22610 Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
THE NONLINEAR INTERACTION OF AN ELECTROMAGNETIC WAVE WITH A TIME-DEPENDENT PLASMA MEDIUM
Robert J. Papa Apr. 1964 42 p refs *Its* Physical Sci. Res. Papers No. 8
(AFCRL-64-250; AD-601669)

A one-dimensional, inhomogeneous model is used to describe the nonlinear interaction of a radiofrequency plane wave with a time-varying plasma medium. A monochromatic plane wave is normally incident upon an electron-density

profile where the electron-density gradients are shallow compared to a wavelength. Changes in electron temperature and electron density are induced that continually alter the pattern of electromagnetic energy deposition into the medium. The electron energy relaxation time is much longer than the period of the electromagnetic wave, so that the electron temperature does not follow the rapid variations in the impressed field. The interelectron collision frequency is much larger than the frequency for energy transfer between electron gas and neutral gas. Hence, the Maxwellianization time for the establishment of electron temperature is short compared to the time for energy transfer between electron and neutral gas. A nonlinear constitutive relationship is derived relating the macroscopic-current density to the impressed electric vector, assuming that the wave field is almost monochromatic in the medium. The time-dependent response of the plasma medium may be found by numerically solving the energy-balance equations and the continuity equation for the electron gas. The electron temperature is expressed in the form of a difference equation where the effects of the thermal conductivity of the electron gas may be included. The spread in frequency of the electromagnetic wave field due to the time-varying electrical conductivity may be computed by employing the WKB approximation as a solution to the wave equation for a time-varying medium. Author

N64-22681 Itek Corp., Palo Alto, Calif. Vidya Div.
A SURVEY OF PLASMA DIAGNOSTIC TECHNIQUES
Wright-Patterson AFB, Ohio, ARL, May 1964 66 p refs
(Contract AF 33(616)-8338)
(ARL-64-80; AD-601659)

The status of instrumentation and diagnostic techniques for use with high-temperature plasmas and especially with gases heated in arc-jet heaters are reviewed as of about the middle of 1963. The performance range of arc-jet heaters is discussed to aid in delineating the required measurement regimes. Diagnostic techniques for the following plasma quantities of interest are discussed: density, temperature dissociation, ionization and electron density, pressure, enthalpy, and velocity. Attempts are made in many cases to delineate the ranges of validity of the techniques discussed. Author

N64-22698 Toronto U. (Canada)
A STATE-OF-THE-ART SURVEY OF SOME ASPECTS OF THE MECHANICS OF RAREFIED GASES AND PLASMAS
G. N. Patterson Wright-Patterson AFB, Ohio, ARL, Apr. 1964 236 p refs
(Contract AF 33(616)-6990)
(ARL-64-60; AD-600873)

The special form of the Boltzmann equation for free molecule flow and the associated boundary conditions governing the distribution function are discussed. The latter involves the interaction of gas particles with surfaces. The subject of near-free-molecule flow is introduced by a consideration of molecular beams and the effect of collisions on beam strength. An integral equation form for the Boltzmann relation, which facilitates an iterative method of solution, is shown to be a suitable basis for a study of the properties of near-free-molecule flow. The Boltzmann equation is reconsidered for the more general case of an ensemble of identical charged particles. Relativistic effects are included. Author

25 PHYSICS, SOLID-STATE

Includes semiconductor theory; and masers. *For related information see*: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N64-21503 Polytechnic Inst. of Brooklyn, N.Y. Microwave Research Inst.
RESEARCH IN ELECTROMAGNETICS, PLASMAS AND NETWORKS Final Report, 1 Jul. 1958–31 Dec. 1962
L. B. Felsen 13 Feb. 1963 60 p refs
(Contract AF 19(604)-4143)
(PIBMRI-1112-63; AFCRL-63-53; AD-402313)

Two separate programs are discussed—electromagnetics and network theory. The electromagnetic program was concerned with a broad study of wave propagation and of diffraction phenomena in layered or inhomogeneous media, and in anisotropic media; and of diffraction by variously shaped objects having constant or variable surface impedance properties. Many of the analyses described were motivated by current topics involving plasmas, and such practical applications as radar communication with, or radar detection of, plasma-sheathed space vehicles, plasma diagnostics, etc., were considered in devising idealized prototype problems that can be subjected to rigorous analysis. A variety of novel wave phenomena were discovered and are described. The networks program was concerned with the erection of a firm structure for Darlington synthesis and with the solution of the problem of optimum multiple-channel filter design for the case of rational spectral densities. I.v.L

N64-21562 Sperry Gyroscope Co., Great Neck, N.Y. Electro-Optics Group
ELECTROMAGNETIC ANGULAR ROTATION SENSING Interim Engineering Report No. 3, 16 Nov. 1963–15 Feb. 1964
W. Macek, D. Davis, R. Salamon, and G. White Feb. 1964 42 p refs
(Contract AF 33(657)-11433)
(AB-1108-0016-3; AD-431654)

Faraday ring-laser biasing, without quarter-wave plates, is described. Beat frequencies up to 3,000 cps have been obtained for fields of 500 gauss using both permanent magnets and electromagnets. For this bias, laser oscillation must occur in a quasi-elliptical mode achieved through Brewster-angle window misalignment. The 108-cm miniature ring laser has shown improved stability, permitting it to be held in the hand and turned, and also to be operated on a gyro test table. A graphical technique for the analysis of laser resonator mode configurations has been developed. An analysis of frequency pulling and mode locking is given, based on the three basic ranges of ring-laser operation: rotation at high angular velocity, rotation at very low angular velocity, and varying rotation from high to lower angular velocities. Author

N64-21583 Battelle Memorial Inst., Columbus, Ohio
EFFECTS OF PLASTIC DEFORMATION, ANNEALING, AND FATIGUE ON THE ELECTRICAL PROPERTIES OF INDIUM ANTIMONIDE Final Report, 1 Apr. 1956–31 Mar. 1964
J. J. Duga and A. H. Clauer 15 May 1964 24 p refs
(Contract Nonr-1870(00))
(AD-600256)

The behavior of a plastically deformed InSb semiconductor is analyzed to provide information on the transport mechanisms of defect generation and interaction. Observations of deformation-induced changes in electrical properties are used to analyze the cases of uniaxial compression, plastic bending, and multiple deformations. In combination with metallographic examination, criteria are established for dislocation climb and polygonization, and a model is proposed whereby the early stages of dislocation interactions and fatigue failure can be observed. D.S.G.

N64-21649 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RAYS TO THE COSMOS
V. A. Fabrikant 10 Sep. 1962 39 p Transl. into ENGLISH of the Book "Luch Idet v Kosmos", Moscow, Izd. Znahiye, 1961 30 p
(FTD-TT-62-867/1+2; AD-286622)

Einstein was the first to indicate that if an atom is in an electromagnetic radiation flux, additional atomic transitions from higher to lower levels should be forced by this radiation. These induced transitions are accompanied by the emission of photons. Molecular radio-wave generators have been constructed that make use of induced radiation. The principle, enunciated by Einstein, of minute equilibrium (i.e., within a heated body in a state of thermal equilibrium, equality should prevail between the numbers of atoms descending and ascending by each group of processes taken separately) threatened to prevent the proof of the existence of induced radiation. The authors overcame this barrier to experimentation by creating what they term "negative temperature" conditions. The paper describes this experiment and details the optical applications of the principle and its significance for cosmic exploration. A.W.

N64-21674 Naval Research Lab., Washington, D.C. Electronics Div.
SYSTEM FOR MEASURING SEEBECK COEFFICIENT AND RESISTIVITY
J. E. Ivory 19 Feb. 1964 13 p refs
(NRL-6044; AD-433673)

A system has been devised that combines a rapid method for measuring Seebeck coefficient with the Dauphinee and Mooser circuit for measuring resistivity. This system can be used from liquid helium temperature to 1,000° C. A temperature range from room temperature to 1,000° C and back can be covered in less than 3 hours giving about 20 data points per hour for each of the two quantities measured. Author

N64-21682 United Aircraft Corp., East Hartford, Conn. Research Labs.
CONTROL OF LASER PERFORMANCE Quarterly Status Report No. 3, Dec. 26, 1963–Mar. 25, 1964
G. E. Danielson, Jr. and A. J. De Maria 31 Mar. 1964 17 p refs
(Contract DA-19-020-AMC-0170(A))
(C-920083-9; AD-434166)

Studies of the effect on laser output control of varying the refractive index of a medium in a laser cavity are being carried out with ultrasonic, electric, or magnetic means. Initial tests of the glass prism light shutter were conducted with a visible He-Ne laser beam mechanically chopped at approximately 83 cps to facilitate modulation percentage measurements. Experimental results showed that approximately 80% modulation was obtained. Gating of a 3 × 1/4 in. diam. Nd^{3+} doped glass laser rod with 1-mc transducers bonded to the ends produced an increase in peak and total output power. An improved ultrasonic standing wave can be obtained with the use of one complete cylindrical transducer instead of two 180° focusing sections. Author

N64-21705 Hahn-Meitner-Institut für Kernforschung, Berlin (W. Germany)
RARE-GAS DIFFUSION IN SOLIDS [DIFFUSION VON EDELGASEN IN FESTKORPERN]
F. Felix, P. Schmeling, and K. E. Zimen Brussels, Euratom, Sep. 1963 35 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-064-61-8-RDD)
(EUR-259.D; EURAEC-526) Available from Belgian Am. Bank and Trust Co., N.Y., account no. 121.86: 50 Belg. Fr.

This is a summary of the work done on rare-gas diffusion in solids. The evaluation of post activation diffusion (PAD) measurements, the experimental methods used for the diffusion measurements, and the assay of the radio active rare gases are described. Experimental results of PAD measurements on the system CaF_2/Ar, KF/Ar, KC1/Ar, UO_2/Xe, ThO_2/Xe are given in the form of release curves and activation energies. Deviations from the ideal case of pure volume diffusion are observed with polycrystalline and sintered material and are discussed in a short survey of parameters affecting the rare-gas release from solids. Author

N64-21713 Harvard U., Cambridge, Mass. Cruft Lab.
THE VARIATION OF PERIODICITY OF MAGNETIC STRUCTURE WITH DILUTION AND TEMPERATURE FOR THE HEAVY RARE-EARTH METALS
Bernard R. Cooper 24 Feb. 1964 11 p refs
(Contract AF 19(628)-3878)
(AFCRL-64-199; AD-600772)

A discussion is given of the several possible mechanisms proposed to account for the variation of periodicity of magnetic order for the heavy rare-earth metals. The relationship between the thermal variation of periodicity for a given metal and the variation of periodicity among the various metals at the ordering temperature is considered. Emphasis is put on the importance of the neutron diffraction experiments on alloys of heavy rare-earth metals diluted with yttrium for understanding the mechanism causing the periodicity variation. The type of interaction that seems most reasonable in fitting the various experimental evidence is suggested. Author

N64-21725 Mallory (P.R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science
INVESTIGATION OF ULTRA HIGH VACUUM SPUTTERED THIN FILMS Scientific Report No. 1
S. P. Wolsky May 1964 35 p refs
(Contract AF 19(628)-3840)
(AFCRL-64-360; AD-600799)

The initial results of an investigation into the application of rigidly controlled low-pressure sputtering techniques to the formation of thin semiconductor films are presented. A unique sputtering chamber has been developed that allows simultaneous deposition on two substrates whose temperatures are controlled independently. Structural and electrical properties of germanium films deposited on quartz and self-substrates are presented. One of the most significant structural factors is the observance of epitaxy at temperatures below 200° C. Hall coefficient, resistivity, and mobility data for germanium on quartz films closely resemble that of other workers. Electrical measurements have also been made on an amorphous n-type film. Author

N64-21742 Oak Ridge National Lab., Tenn. Oak Ridge Y-12 Plant
X-RAY FLUORESCENCE TABLES: ETHYLENEDIAMINE DEXTROTARTRATE (EDDT) CRYSTAL
W. P. Amsbury, W. W. Lee, J. H. Rowan, and G. E. Walden 12 Jun. 1964 177 p
(Contract W-7405-ENG-26)
(Y-1470-D) OTS: $2.75

A critical compilation of standard reference tables of X-ray fluorescence lines has been published in convenient form for experimental use. This section of the report contains tables calculated for an ethylenediamine dextrotartrate (EDDT) crystal. Author

N64-21745 General Dynamics Corp., San Diego, Calif. General Atomic Div.
TRANSIENT IONIC SPECIES RESULTING FROM GAS-SOLID INTERACTIONS: O_2 ADSORPTION ON NiO
H. Saltsburg, D. P. Snowden, and M. C. Garrison 4 Mar. 1964 33 p refs Submitted for Publication
(Contract DA-44-009-ENG-4832)
(GA-4979; AD-434480)

The effect of the pulsed adsorption of oxygen on the conductivity of powdered NiO has been investigated over a frequency range from 10^3 to 10^{10} cps. From a study of the magnitude of the relative conductivity change as a function of frequency it is possible to identify the frequency range over which surface effects dominate the conductivity. At all frequencies, however, after a sharp conductivity increase caused by oxygen adsorption, the conductivity decays very slowly and nonexponentially back toward its initial value. This decay is shown to be due neither to desorption of adsorbed oxygen nor to lattice incorporation. Since at 400°C the fraction of the adsorbed species ionized is found to be 5×10^{-5} and since the conductivity decay is nonexponential, it is suggested that the decay is caused by multiple electronic transitions of the adsorbed oxygen between an ionized and an un-ionized excited state before final deexcitation to a neutral adsorbed species. Author

N64-21767 Northwestern Technological Inst., Evanston, Ill. Aerial Measurements Lab.
SOLID STATE ANALOG-TO-DIGITAL CONVERTER Final Report
Viola J. White and Robert E. Onley 30 Dec. 1963 60 p refs
(Contract NOw-62-0749-D)
(Memo-400; AD-428846)

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1. SOLID STATE ANALOG-TO-DIGITAL CONVERTER V. J. White and R. E. Onley 26 p refs (See N64-21768 15-25)
2. ELECTRON AND HOLE INJECTION BY A METAL-DEPLETION LAYER CONTACT P. G. Sedlewicz, R. E. Onley, and C. R. Kannewurf 34 p refs (See N64-21769 15-25)

N64-21768 Northwestern Technological Inst., Evanston, Ill. Aerial Measurements Lab.
SOLID STATE ANALOG-TO-DIGITAL CONVERTER
Viola J. White and Robert E. Onley *In its* Solid State Analog-to-Digital Converter 30 Dec. 1963 26 p refs (See N64-21767 15-25)

Research on the feasibility of fabricating a solid-state analog-to-digital converter (ADC) was based on the movement of the depletion region of a reverse biased p-n junction in silicon and on the detection of that movement. The on–off characteristics of a probe placed on the beveled semiconductor surface within the range of movement demonstrated the mechanism of the ADC. The fabrication difficulties caused by the precise positioning requirement, mechanical instability of the point contact, unstable surface conditions, and ohmic contact requirements limited the application of the device as a circuit element. Although the characteristics could not be stabilized over a period of time, and the desired resolution was not obtained, the feasibility of fabricating a multiple probe ADC device was demonstrated. D.S.G.

N64-21769 Northwestern Technological Inst., Evanston, Ill. Aerial Measurements Lab.
ELECTRON AND HOLE INJECTION BY A METAL-DEPLETION LAYER CONTACT
P. G. Sedlewicz, R. E. Onley, and C. R. Kannewurf *In its* Solid State Analog-to-Digital Converter 30 Dec. 1963 34 p refs (See N64-21767 15-25)

The injection of electrons and holes by various metal probes into the depletion region of a beveled silicon p-n diode was experimentally studied. The electrical and thermal properties of metal pressure contacts are presented and used to identify the nature of the injection mechanism. The characteristics of electron injection are the space-charge-limited type, and the hole injection characteristics follow a high field process. A potential energy diagram of the metal-depletion layer contact is presented and appears to be in agreement with the observed injection phenomena. Author

N64-21784 Martin Co., Orlando, Fla.
LASERS AND THEIR EFFECTS Annual Progress Report, 1 Jul. 1963–1 Mar. 1964
James H. Burkhalter 1 Apr. 1964 49 p
(Contract DA-49-193-MD-2456)
(OR-3885; AD-433218)

A description is given of the work performed for the Biological Effects of Lasers Program of the Office of the Surgeon General. This includes the design and construction of a research laser and associated instrumentation for the attack on problems of interest to the biological researchers of the program. A discussion is presented of the more important problems to date of the various biological researchers, together with the approaches used. Author

N64-21795 Martin Co., Orlando, Fla.
EXCITATION AND DETECTION TECHNIQUES FOR MILLIMETER WAVE TRANSITIONS Quarterly Progress Report No. 6, 1 Oct. 1963–1 Jan. 1964
J. J. Gallagher, R. G. Strauch, and R. E. Cupp Mar. 1964 29 p refs
(Contract DA-36-039-SC-90753)
(OR-3821; AD-434001)

The electron bombardment ionizer has been improved to the extent that it has been possible to observe an RF electric resonance in hydrogen sulfide. Testing of oscillators against the ammonia maser is continuing. Work on the small molecular beam system is reported, and the status of millimeter spectroscopy investigations is discussed. Author

N64-21832 General Dynamics/Pomona, Calif. Physics and Infrared Section
VACUUM EVAPORATED AND CATHODIC SPUTTERED THIN FILMS
E. Krikorian, R. J. Sneed, P. Chen, and B. Berson Mar. 1964 82 p refs
(Contract AF 33(657)-8728)
(RTD-TDR-63-4264; AD-433828)

The effects of formation conditions on the epitaxial growth of thin films deposited by cathodic sputtering and vacuum evaporation are reported. The primary condition parameters considered are substrate temperature and rate of deposition. Trends were established for the effect of thickness, annealing, and residual gas pressure. The results of a detailed investigation of Ge sputtered onto single crystal Ge are presented. Less detailed, but consistent results were obtained for identical film-substrate systems obtained by vacuum deposition. Data are also included for Ge deposited on single-crystal Si, mica, amorphous quartz, and glass. Other film-substrate systems considered include gold on rock salt and glass, silver on rock salt, and silicon on silicon. The systematic dependence of the epitaxial temperatures and amorphous-crystalline transition temperatures of Ge films on the primary formation conditions is shown. A qualitative, theoretical model describing the epitaxial process is

suggested. Initial data on the electrical properties of films produced both by sputtering and vacuum evaporation are presented. Author

N64-21846 New York U., N.Y. Courant Inst. of Mathematical Sciences
WAVE MOTION IN A PLASMA BASED ON A FOKKER-PLANCK EQUATION
Alan Oppenheim 31 Mar. 1964 93 p refs
(Contract AT(30-1)-1480)
(NYO-9371; MF-39)

An isotropic approximation to the Fokker–Planck collision operator (IFP model) was constructed to study small amplitude wave motion of an unbounded, fully ionized, neutral, two-component plasma in a steady applied magnetic field. The linearized Boltzmann's equations with Maxwell's equations were solved, and the dispersion relation was constructed. Because the isotropic Fokker–Planck operators describe a diffusion process in velocity space, whereas the previously considered Krook relaxation models do not, an infinite number of new Larmor resonances modes at arbitrary directions of propagation with respect to the applied magnetic field were found. The new resonances remain in the limit of long macroscopic wavelengths and small collision frequencies. At propagation parallel to the applied magnetic field, new resonances for wavelength large and small with respect to the mean free path were found. In other macroscopic ranges, the Krook and IFP models gave similar results. As a special example, the Faraday rotation formula for a particular collisional plasma was verified. Author

N64-21854 Union Carbide Nuclear Co., Oak Ridge, Tenn.
X-RAY FLUORESCENCE TABLES: GYPSUM CRYSTAL
W. P. Amsbury, W. W. Lee, J. H. Rowan, and G. E. Walden 19 Jun. 1964 182 p refs
(Contract W-7405-ENG-26)
(Y-1470-E) OTS: $2.75

A critical compilation of standard reference tables of X-ray fluorescence lines has been published in convenient form for experimental use. This section of the report contains tables calculated for a gypsum crystal. Author

N64-21875 Michigan U., Ann Arbor Infrared Lab.
OPTICAL CONSTANTS OF GERMANIUM
W. L. Wolfe, J. A. Jenney, W. C. Levengood, T. Limperis, and D. M. Szeles Mar. 1964 39 p refs
(Contract Cwb-10533)
(Rept.-5557-4-F; AD-435012)

An analysis has been made of the effects of change of refractive index of germanium on radiometric calibration; this analysis shows that the index cannot change by more than 0.01 if 2% accuracy is to be maintained, unless calibration procedures are used to account for this change. Several methods of measuring index have been investigated; as a necessary preliminary, the effects of changes in temperature and pressure on index were evaluated. For the usual atmospheric conditions, variations of 50° C or 50 torr will cause changes of no more than ± 0.00001 of the refractive index of air. If temperature or pressure measurements can have errors as large as 50° C or 50 torr, then the error or uncertainty in index can be as large as 10^{-5}. Similarly, the sample must be measured to ± 0.04° C. Each of nine possible techniques has been analyzed in terms of the precision necessary in the measurement of each of the independent variables. Deviation techniques, reflection techniques, interferometric methods, and a sphere method are discussed. Author

N64-21940 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE POSSIBILITY OF LOCATING THE BOUNDARY OF PENETRATING PLASMA BY A BEAM OF CHARGED PARTICLES
M. D. Gabovich, O. O. Lozova, and L. I. Romanyuk 10 Dec. 1963 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 8, no. 1, 1963 p 57–60
(FTD-TT-63-1089/1+2; AD-426898)

A method of locating the boundary of penetrating plasma based on the utilization of a charged-particle beam and the electron-optical properties of the plasma boundary is discussed. The principle of this method is that the boundary of the penetrating plasma separates two sharply differing zones. Small electric fields exist in the plasma, whereas beyond the plasma boundaries, the electric fields of the lens are greater by several magnitudes. I.v.L.

N64-21953 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MOBILITY OF ELECTRONS IN HIGHLY ALLOYED SILICON
E. M. Omel'yanovskiy, V. I. Fistul', and M. G. Milvidiskiy 23 Aug. 1963 11 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Leningrad), v. 5, no. 3, 1963 p 921–927
(FTD-TT-63-687/1+2; AD-428315)

Investigated were the temperature and concentration dependence of the Hall mobility of electrons in silicon, alloyed with arsenic and phosporus admixtures. Evaluation of the experimental results shows that the dependence of mobility upon concentration at various temperatures in alloyed silicon cannot be explained by the ordinary theory of diffusion on admixture ions. N.E.A.

N64-21970 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SILICON DETECTORS OF THERMAL NEUTRONS
J. Chwaszczewska and A. Szechter 26 Mar. 1964 8 p refs Transl. into ENGLISH from Nukleonika (Warsaw), v. 8, no. 7, 1963 489–493
(FTD-TT-64-95/1+2; AD-600583)

Surface-barrier silicon detectors of heavy-charged particles were used for the detection of thermal neutrons by means of covering them with layers of boron, lithium, or uranium. Detectors of thermal neutrons were obtained with sensitive surface of 10 to 500 mm^2 using silicon with a specific resistance of 265 ohm-cm and 1,000 ohm-cm. The effectiveness was measured, and some characteristics were determined. Author

N64-21997 Keystone Controls Corp., Newark, N.J.
5 MC SINGLE SIDEBAND CRYSTALS First Quarterly Progress Report, 1 Jul.–30 Sep. 1963
Raymond F. Woolley [1963] 25 p refs
(Contract DA-36-039-AMC-03307(E))
(Rept.-1; AD-431271)

The report reviews the requirements and previous literature indicating that Q of 3×10^6 is possible at a frequency of 5 mc. To reach the desired Q, it is indicated that a plano–convex blank is necessary, together with evacuation of the unit in a glass holder. Maintenance of angle of orientation to ± 15 seconds of the Z–Z' will be necessary to achieve the desired change in frequency. Proposed improvements to the frequency standard and measurements system are detailed, as well as a description of an oven to be used for aging measurements. The complete prototype crystal unit design specification is included. Author

N64-22056 Hp Associates, Palo Alto, Calif.
SEMICONDUCTOR MATERIALS Interim Engineering Report No. 2, 27 Sep.–26 Dec. 1963
R. J. Archer et al [1963] 56 p refs
(Contract NObs-89489)
(AD-433725)

Preliminary tests on integrated GaAs and GaAs-GaP el diode arrays are reported. Work on material synthesis and structural investigation of boron phosphides has been completed. Progress on material and device technology using GaAs-GaP alloy el diodes is described. Measurements of spectral distribution, absolute luminance, and quantum yields are reported. Diodes fabricated from an alloy of 58% GaAs and 42% GaP produce 25 to 30 footlamberts with external photon–electron yield of 10^{-5}. This is obtained by applied voltages of less than 5 v. Author

N64-22067* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
IMAGE PROPERTIES OF A SUPERCONDUCTING GROUND PLANE
A. R. Sass Repr. from J. Appl. Phys., no. 3 (Part I), Mar. 1964 p 516–521 refs
(NASA-RP-187)

The Green's-function technique is used in the determination of the field distribution of an infinitely long current carrying conductor of arbitrary but constant cross section above a superconducting ground plane of finite thickness. It is assumed that the superconductor can be described by the phenomenological London equations. The integral expressions that are obtained are solved analytically for a few special cases of interest. Under conditions that are often encountered in a physical system, a modified image method can be used to calculate the field distribution to within 2% of the computer solution. Author

N64-22147 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE KINETICS OF DISRUPTING SUPERCONDUCTIVITY BY A VARIABLE FIELD
I. M. Lifshits and F. I. Tsikovich 14 Feb. 1963 19 p refs Transl. into ENGLISH from Uchenyye Zapiski, v. 64, Tr. Fiz. Otd. Fiz.-Mat. Fak., Izd. Khar'Kovskiy Univ., (USSR), v. 6, 1955 p 45–57
(FTD-TT-62-1716/1+2; AD-400533)

This report gives a more thorough explanation than previously made of results of determining the kinetics of disruption by a longitudinal magnetic field of the superconductivity of a cylindrical sample. Basic results are given for a variable field, in relation to relaxation, sample curvature, and thermal effects. N.E.A.

N64-22159 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EQUATION OF STATE FOR SOLID BODIES
B. I. Davydov 23 Mar. 1964 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geofiz. (Moscow), no. 12, 1956 p 1411–1418
(FTD-TT-63-1113/1+2+4; AD-600614)

Proceeding from the general concepts of the quantum theory of solid bodies, approximation expressions are obtained for the free energy of basic types of crystalline solid bodies (ions, valent and molecular crystals, metals). These expressions make it possible to obtain the equation of state as well as the compressibility and coefficient of thermal expansion as a function of pressure and temperature by the usual method. Constants entering into the formulas may be determined on the basis of experiments carried out at low pressure. The equations obtained are valid up to pressures at which some phase change takes place. Curves are given for several types of solid bodies (NaCl, MgO, Fe_3O_4, Mg_2SiO_4, Si, Ge, Fe). Author

N64-22204 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
QUARTZ CRYSTAL AGING EFFECTS Quarterly Report, 15 Aug.–15 Nov. 1963
R. B. Belser, W. H. Hicklin, and R. A. Young 15 Nov. 1963 63 p
(Contract DA-36-039-AMC-02251(E))
(QR-3; AD-434674)

Aging measurements have been conducted on approximately 246 quartz resonators of various types. These included aging studies of 97 units of 16-mc frequency, fabricated for radiation effect determination; 43 units of 10-mc frequency for reliability determination; 84 units at low frequency (100, 250, and 500 kc); and 24 resonators of 3-mc frequency for comparison of units made of natural, natural swept, cultured, and cultured swept quartz. Experiments designed to give more precise interpretation of X-ray-diffraction source image-distortion patterns were conducted, and advances in the analyses of patterns were made with respect to the direction and the quantity of curvature of distorted blanks. N.E.A.

N64-22222 Lincoln Lab., Mass. Inst. of Tech., Lexington
SOLID STATE RESEARCH, 1963
9 Mar. 1964 82 p refs
(Contract AF 19(628)-500)
(ESD-TDR-64-16; AD-435023)

This report on solid-state research includes the following: solid-state devices, lasers, solid-state materials, band structure and spectroscopy of solids, and magnetism and resonance. J.R.C.

N64-22225 Brookhaven National Lab., Upton, N.Y.
THE EFFECTS OF CRYSTALLINE BINDING ON THE DOPPLER BROADENING OF A NEUTRON RESONANCE
Austin Bernabei (Ph.D. Thesis) Jun. 1964 135 p refs
(BNL-860(T-344)) OTS: $2.50

The 4.14 ev resonance in tungsten-182 is a narrow resonance and was selected for the Doppler study reported here. The shape of this resonance was measured to high accuracy at four different temperatures, 4.2°, 77.8°, 296°, and 825°, using a metal sample. The shape of the resonance was also measured, using a heavy water solution of sodium tungstate at 296° K. At a series of intermediate temperatures between 4.2° and 825° K, the peak cross section of the resonance was measured. For measurements above room temperature, an oven was used; below room temperature, a cryostat was used. The source of neutrons was graphite reactor, and the monochromator employed was a crystal spectrometer. Author

N64-22237 ITT Communication Systems, Inc., Paramus, N. J.
APPLICABILITY OF LASER TECHNIQUES Status Report
W. S. Litchman 13 Mar. 1964 80 p refs
(Contract AF 19(628)-3358)
(ICS-64-TR-379; ESD-TDR-64-249; AD-434378)

This report presents laser communication techniques that can be integrated into the AIRCOM System to satisfy current and estimated future Air Force requirements. Described in detail, are the characteristics of the laser and problems related to light generation, modulation, and detection. These characteristics will aid in visualizing a number of possible applications in which a laser communication link can be advantageously employed in the AIRCOM system. Some of the possible applications are described. N.E.A.

N64-22271 Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

CAPACITANCE-VOLTAGE DEPENDENCE OF ZINC-DIFFUSED GaAs p-n JUNCTIONS

L. W. Aukerman, D. F. Kyser, and M. F. Millea 1 Jun. 1964 30 p refs

(Contract AF 04(695)-269)

(SSD-TDR-64-42; TDR-269(4250-11)-2; AD-600696)

The capacitance-voltage behavior of zinc-diffused GaAs p-n junctions indicates a severe nonlinearity of the impurity distribution near the junction. This is probably due to the non-Fickian nature of zinc diffusion in GaAs. The capacitance of zinc-diffused GaAs p-n junctions varies as $C \propto V^{-1/n}$ where the n values range from 2, as for an abrupt junction, to 3, as for a linear gradient junction. The capacitance-voltage relations for two assumed zinc profiles are calculated and compared with experimental results. A linear gradient on the p-side and a constant donor concentration equal to the starting donor concentration on the n-type side are found to be a good approximation of the actual impurity distribution at a zinc-diffused p-n junction. Author

N64-22276 Sperry Microwave Electronics Co., Clearwater, Fla.

DEVELOPMENT OF ADVANCED MICROWAVE COMPONENTS AND TECHNIQUES—PLANAR HEXAGONAL FERRITES AND DEVICES

Griffiss AFB, N.Y., RADC, Apr. 1964 46 p refs

(Contract AF 30(602)-2757)

(RADC-TDR-64-78; AD-600871)

Studies were made of the effect of various processing variables on the dielectric loss of the planar hexagonal ferrites. Loss tangents that are of the order of 0.02 are the most severe limitations of the materials. Linewidths of approximately 290 oersteds were obtained on the $Cu_{0.75}Zn_{1.25}$ Y compound. Attempts at orienting the grains of cubic polycrystalline materials produced yttrium iron garnet ($3Y_2O_3{\cdot}5Fe_2O_3$) with a linewidth of 18.5 oersteds, yttrium gadolinium iron garnet ($3Y_{0.8}Gd_{1.2}O_3{\cdot}5Fe_2O_3$) with a linewidth of 156 oersteds, and nickel ferrite ($NiFe_2O_4$) with a linewidth of 379 oersteds. Measurements and analyses of the application of planar hexagonal ferrites in isolator performance are reported. While the anisotropy field of the planar ferrite reduces the external field required for resonance, it also adversely effects some isolator characteristics. Measurements were made on both E- and H-plane configurations. The E-plane configurations provide isolation ratios of approximately 10:1 without dielectric loading; and with dielectric loading ratios of approximately 20:1 are obtained. The dielectric loss of the ferrite is the limiting factor in the reported isolation ratios for the E-plane slab. The H-plane configurations provided isolation ratios of approximately 20:1 without dielectric; and with dielectric loading ratios of approximately 50:1 are obtained. Author

N64-22336 Minneapolis-Honeywell Regulator Co., Hopkins, Minn. Honeywell Research Center

THERMAL-MECHANICAL HISTORY AND THE STRENGTH OF MAGNESIUM OXIDE SINGLE CRYSTALS. I. MECHANICAL TESTS

R. J. Stokes Mar. 1964 45 p refs

(Contract AF 33(616)-7465)

(HR-64-258; AD-437173)

Various dislocation impurity interactions in magnesium oxide and their effect on mechanical properties between room temperature and 1,000° C are discussed as follows: (1) Impurity precipitate particles present in single crystals can be redistributed by heat treatment. Their size and density affect the lattice resistance to fresh dislocations and thus the yield strength at room temperature. Above 1,200° C impurities go into solid solution, and strength drops to 0.7 of the as-received fully precipitated value. (2) Fresh dislocations can be locked by heating above 600° C to produce yield phenomena at room temperature. (3) The basic temperature dependence of the yield strength contains two regions. Up to 500° C strength decreases rapidly, suggesting a dislocation cutting mechanism during flow. Above 500° C strength decreases linearly at a rate equal to elastic modulus, suggesting long-range interaction of dislocations with internal stress fields. Author

N64-22374 Air Force Systems Command, Wright-Patterson AFB, Ohio Materials Lab.

BRAGG ANGLES FOR SOME SOFT X-RAY EMISSION LINES USING KAP AND RbAP ANALYZING CRYSTALS

David W. Fischer Feb. 1964 198 p refs

(ML-TDR-64-2; AD-431724)

A complete table of 2θ values for soft X-ray emission lines using potassium acid phthalate (KAP) and rubidium acid phthalate (RbAP) analyzing crystals is presented. All the lines of the K, L, and M series from 1.5A to 25A are included. Author

N64-22393 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

THEORY OF SUPERCONDUCTIVITY

N. N. Bogolyubov 13 Feb. 1963 12 p Transl. into ENGLISH from Nauka i Zhizn' (Moscow), no. 8, 1958 p 17-20

(FTD-TT-62-1714/1+2; AD-400554)

A new theory of superconductivity is proposed. This theory is based on a theory of superfluidity and takes into systematic account the electrostatic repulsion of the electrons. The behavior of the electrons in the superconductive state can be pictured as follows. The free electrons in this state form a bound collective, with properties similar to the "condensate" in the theory of superfluidity. In order to tear an electron out of this collective, it is necessary to engage in work, the magnitude of which is of the same order as the heat energy corresponding to the temperature transition from the superconductive to the normal state. Due to such a bond, the movement of the collective as a whole proves to be stable; the electric current in the metal does not meet with resistance. The electrostatic repulsion of the electrons operates against the formation of a "condensate." However, this repulsion operates more weakly than was assumed in the Bardeen-Cooper-Schrieffer theory. The new theory makes it possible to compute the oscillations of the collective of electrons and to establish the existence of a special kind of excitation—electronic waves, the energy of which is inversely proportional to their length and directly proportional to the maximum velocity of the electrons. I.v.L.

N64-22405 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

PRINCIPLE OF THE MOLECULAR AMPLIFIER AND GENERATORS OF COHERENT LIGHT

B. M. Yavorskiy 1 Apr. 1963 14 p refs Transl. into ENGLISH from Svstotekhnika (Moscow), no. 2, 1962 p 1-5

(FTD-TT-62-1822/1+2; AD-402436)

The principles of generators of coherent light (optical masers or lasers) and of molecular amplification are discussed. The scheme of the generators of light is based on the use of the principle of molecular amplification of electromagnetic waves. The principle of molecular amplification is, in turn, based on using the phenomenon of forced (induced or stimulated) emission, theoretically predicted by Einstein. Also, various types of generators of light and methods of molecular amplification are reviewed. I.v.L.

N64-22419* Maryland U., College Park Computer Science Center
CRYSTAL STRUCTURE CALCULATIONS SYSTEM X-RAY—63 FOR THE IBM 709/7090/7094
Apr. 1964 96 p
(Grant NsG-398)
(NASA-CR-56479; TR-64-6) OTS: $8.60 ph

This report is designed to serve as an introduction to a set of programs for doing the calculations necessary to solve crystal structures by diffraction techniques. It briefly describes the structure of the system, lists the current links in the system, and shows an example of the use of some of the programs of the system. The detailed users manual is maintained as an expandable file of card images on magnetic tape to be distributed with the current version of the system tape. The system is designed to be run in conjunction with, or exclusive of, any monitor. This report is specific for the IBM 709/7090/7094. Author

N64-22426* Maryland U., College Park
X-RAY 63. PROGRAM SYSTEM FOR X-RAY CRYSTALLOGRAPHY FOR THE IBM 709–7090–7094
Apr. 1964 305 p Prepared in conjunction with Washington U.
(Grant NsG-398)
(NASA-CR-56472) OTS: $19.75

Programs are described that are designed to constitute a system for X-ray crystallography to run independently of, or in conjunction with, existing IBM–709–7090–7094 monitors. The major subroutines of the system perform the calculations necessary to interpret X-ray-diffraction patterns and to establish accurate atomic parameters in crystals. The manual is divided into three parts. The first part is a "users guide," giving the method and plan of calculation. The second part gives directions for use of the programs in terms of card formats and card order. The third part is a series of appendices to aid in adapting the system to various monitors and installations. All programs, subprograms, and subroutines in the X-ray crystallography-program system depend upon the FORTRAN (II)-FAP programing system. P.V.E.

N64-22493 Weapons Research Establishment (Australia)
AN INVESTIGATION INTO THE RESPONSE AND CORRECTIONS TO A THERMISTOR AND A PLATINUM WIRE RESISTANCE THERMOMETER FOR TEMPERATURE MEASUREMENT IN THE UPPER ATMOSPHERE
P. H. O. Pearson Mar. 1964 41 p refs
(PAD-83)

A study was made into the response and corrections required to the results obtained from a 0.01-in.-diam thermistor and a 0.001-in.-diam platinum wire resistance thermometer when they are used as temperature measuring elements in a dropsonde designed for atmospheric studies. Whereas the platinum wire has the better response characteristics, the thermistor is more practical for measurements up to 200,000 ft. Recommendations are made for the mounting of the thermistor on the dropsonde package. Author

N64-22500 Atomic Energy of Canada Ltd., Chalk River, Ontario
THE USE OF GERMANIUM LITHIUM-DRIFT p-i-n DIODES AS HIGH RESOLUTION GAMMA-RAY SPECTROMETERS
G. T. Ewan Apr. 1964 32 p refs Presented at the Ann. Meeting of the Am. Phys. Soc., N.Y., 28 Jan. 1964
(AECL-1960) AECL: $0.50

Lithium-drift germanium diodes have been used to study γ-ray spectra from the X-ray region up to 9 Mev. The resolution obtained at 122 Kev was 3.1 Kev, and at 7,285 Kev was 9.8 Kev. Intrinsic efficiency curves are given for an 18-mm-diam detector with a 3.5-mm depletion depth. A brief description is given of a 3-crystal pair spectrometer using a lithium-drift germanium diode as the central crystal. Author

N64-22530 Sylvania Electric Products, Inc., Waltham, Mass. Sylvania Electronic Systems-East
ACTIVE THIN FILM TECHNIQUES MICROMIN PROGRAM Interim Development Report No. 7, 1 Feb.–30 Apr. 1964
Egons Rasmanis, James Cline, and Robert Tiernan 26 May 1964 97 p refs
(Contract NObsr-87633)
(Q445-7; AD-601021)

Major changes in the high vacuum evaporation equipment included removal of the chemical baffle and replacement of both the former electron gun and source holder by a compact electron beam evaporation source. The rate of silicon deposition was increased from 2 to 12 microns per hour. Vacuum-deposited silicon insulated-gate field effect transistors were fabricated with transconductances in the range 100 to 300. The electrical characteristics of these devices were studied for use in a preamplifier circuit. A number of annealed silicon films have been analyzed by X-ray diffraction, which show that during annealing of rheotaxial silicon films, the orientation changes from preferred (110) with a minor of (331) to (111) orientation, and which firmly establish the improved crystallographic nature of rheotaxially grown silicon films. Modifications were made in the Hall equipment for low-temperature work, and improvements were made in metal contacts to the silicon films. Three films gave mobilities in the range 27 to 40 cm^2/volt-sec at room temperature and 10 to 20 cm^2/volt-sec at 77° K. Author

N64-22564 Utah U., Salt Lake City
HIGH TEMPERATURE DEFORMATION OF RUTILE
Owen W. Johnson, Norman E. Farb (Ph.D. Thesis), and Peter Gibbs Wright-Patterson AFB, Ohio, AF Mater. Lab., Apr. 1964 79 p refs
(Contract AF 33(616)-6832)
(ML-TDR-64-114; AD-601515)

Steady-state, four-point bending strain rate measurements were made on 44 single crystal TiO_2 specimens in the temperature range of 1,100° to 1,230° C under controlled partial pressures of oxygen. The steady-state creep is a thermally activated process that is influenced by the atmosphere, the impurity concentration, and the strain rate. The deformation rate of all specimens is conveniently expressed by the empirical equation $\epsilon = A \exp(B\sigma) \exp(-\Delta H/kT)$ where ΔH is the apparent activation energy, k is Boltzmann's constant, T is the temperature in degrees Kelvin, σ is the stress, and A and B are constants for any given set of experimental conditions. Author

N64-22655 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THERMOELECTRIC SEMICONDUCTOR COOLING DEVICES
1 Aug. 1963 11 p Transl. into ENGLISH from the Publ. "Maschpriborintorg" Moscow p3–11
(FTD-TT-63-692/1; AD-417409)

Uses for thermoelectric semiconductor cooling devices are discussed, and three particular instruments using the devices are described: (1) microscope table with thermoelectric heating and cooling; (2) thermoelectric labor-cooling device; and (3) high vacuum traps with thermoelectric cooling for oil-steam diffusion pumps. P.V.E.

N64-22675* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EXPERIMENTAL EVIDENCE OF DEGRADATION EFFECTS IN SHORT SAMPLES OF HARD SUPERCONDUCTORS
John C. Fakan and Edward R. Schrader (RCA) Jun. 1964 13 p refs
(NASA-TN-D-2345) OTS: $0.50

A model is proposed that may explain degradation of the current-carrying capacity of superconducting magnets. The model is used to explain the experimental results obtained on the basis of the energy released by sporadic flux penetrations (flux jumps). Specifically, it is proposed that the current capacity of a superconducting electromagnet may be controlled by penetrations (in the temperature direction) of the critical surface that defines the superconducting region, and that these penetrations result from flux jumping in the low-field-strength regions of the coil. Suggestions are given for minimizing or avoiding degradation in practical superconducting electromagnets. Author

N64-22686 HP Associates, Palo Alto, Calif.
INVESTIGATION OF HOT ELECTRON EMITTER Scientific Report No. 7, Jan. 1 – Mar. 31, 1964
R. W. Soshea et al [1964] 20 p
(Contract AF 19(628)-1637)
(AFCRL-64-390; AD-601135)

The evaporation characteristics for CdSe are presented, and the film doping density depends greatly on source and substrate temperatures. Platinum was more compatible with the evaporation conditions than gold. Triode structures of the class GaAs-Pt-CdSe and Si-Pt-CdSe were fabricated, and the results are presented. The CdSe may be an adequately good emitter at high current densities to enable the measurement of the triode range L_T to be made in platinum. Author

N64-22710 Army Materials Research Agency, Watertown, Mass. Materials Sciences Lab.
INFRARED RADIATION OF SOLIDS—REFRACTORY MATERIALS
Albert F. Grenis and Albert P. Levitt Feb. 1964 29 p refs
(AMRA-TR-64-03; AD-436252) OTS: $0.75

Apparatus and techniques have been developed for determining the infrared radiation characteristics of solids, including flame-sprayed ceramic coatings, at elevated temperatures. The theoretical basis for the equipment design and operation is discussed. The normal spectral emittance, integrated normal total emittance, and infrared radiation intensity curves of selected solids for different surface conditions have been determined at a temperature of 1,300° K in the wavelength region extending from 1.0μ to 10.0μ. Infrared radiation properties for the three flame-sprayed ceramic coatings—aluminum oxide, chromic oxide, and zirconium oxide—and for one test specimen of solid boron nitride are discussed. It was found that flame-sprayed chromic oxide most closely simulated a blackbody in the wavelength region studied. Author

N64-22716 Inland Testing Labs., Dayton, Ohio
QUARTZ CRYSTAL RELIABILITY STUDIES Quarterly Progress Report, Jan. 1–Apr. 1, 1964
Carleton E. Jones [1964] 36 p
(Contract DA-36-039-AMC-02350(E))
(Rept.-3; AD-601345)

Preproduction testing of crystals for use in reliability studies, and results from first reliability measurements, are reported. Through the close of the reporting period, crystal operating and storage hours totaling 659,250 were completed with no catastrophic failures, and with only a few isolated cases of excessive frequency change. P.V.E.

26 PROPELLANTS AND COMBUSTION

Includes fuels; igniters; and oxidizers. *For related information see*: 07 Chemistry; and 27 Propulsion.

N64-21552 Instituto Nacional De Tecnica Aerospacial, Madrid (Spain)
ON THE STRUCTURE OF LAMINAR DIFFUSION FLAMES
Amable Linan (M.S. Thesis) 1 Jun. 1963 38 p refs
(Grant AF-EOAR-63-43)
(FM-63-2; AFOSR-64-0151; AD-432822)

The structue of laminar diffusion flames is analyzed in the limiting case of large, although finite, reaction rates. It is shown that the chemical reaction takes place only in a very thin region, or chemical boundary layer, where convection effects may be neglected. Then the temperature and mass fraction distributions within the reaction zone are obtained analytically. The flame position, rates of fuel consumption, and temperature and concentration distributions outside of the reaction zone may be obtained by using the assumption of infinite reaction rates. For large Reynolds numbers, mixing and combustion take place in boundary layers and free mixing layers. Again analytical solutions are obtained for the temperature and mass fraction distributions outside of the reaction zone. Author

N64-21570 Frankford Arsenal, Philadelphia, Pa. Research and Development Group
PYROTECHNIC DELAY DEVICES FOR LOW ENERGY DETONATING CORD SYSTEMS
J. F. Kowalick Apr. 1964 21 p refs
(M64-26-1; AD-438910)

Detonating fuse delays developed for use in the blasting industry incorporate powder trains of the sequence: high explosive, to deflagrating composition, to delay composition. Although such delays appear to be in common use, their delay times do not exceed approximately 300 msec and their reliability has not been established. A design problem may exist in scaling up the delay time to the order of several seconds. Functional descriptions of these delays are presented. A method is presented for providing a complete seal between detonating cord and the delay device. Author

N64-21586 Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
MECHANICAL PROPERTIES OF SOLID PROPELLANTS FOR COMBINED STATES OF STRESS AT VARIOUS TEMPERATURES
M. G. Sharma and C. K. Lim Sep. 1963 155 p refs Prepared from work performed at Pa. State U.
(Contract NOrd-16640)
(ABL/X-114; AD-439959)

Three separate methods were developed for characterizing inert solid fuel propellants under combined states of stress at room temperature conditions as follows: (1) The material is characterized in terms of a stored energy function and a dissipated energy function. These functions are determined from hysteresis tests under combined loading. (2) The energy functions are determined experimentally by using a finite viscoelastic theory that is an extension of the finite elastic theory. By this method, the energy functions are determined from one single combined stress test. (3) The combined stress test behavior is predicted from uniaxial-tension stress–strain

law. None of the classical failure criteria apply to this material. Failure envelopes corresponding to the various criteria of failure considered are drawn for various rates of extension ratios. A new criterion of failure for the material is developed. D.S.G.

N64-21646 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTROL OF SECONDARY AIR JETS IN COMBUSTION CHAMBERS OF GAS TURBINES
Tadeusz Haupt 4 Mar. 1963 13 p refs Transl. into ENGLISH from Energetyka (Poland), no. 7, 1962 p 215–218
(FTD-TT-62-1-1786/1+2; AD-299851)

Considerable effect is exercised on the shaping of thermal parameters of the combustion chamber by the distribution of a secondary airmass along the chamber as well as by the depth of penetration of separate streams. The penetration depth can be determined by Ivanov's formula. Investigations on holes other than slotted ones must be expanded, including those on holes with obtuse-truncated edges. The optimum ratio, D/K, should be considered in designing gas-turbine combustion chambers. A.W.

N64-21647 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COMPUTING THE SPEED OF THE NORMAL PROPAGATION OF A FLAME IN A MIXTURE OF HYDROGEN AND CHLORINE
A. G. Istratov and V. B. Librovich 18 Feb. 1963 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 143, no. 6, 21 Apr. 1962 p 1380-1393
(FTD-TT-62-1687/1+2; AD-299849)

The basic assumption of the theory underlying the speed of normal propagation of a flame in which chemical reaction proceeds by a chain mechanism is that all elementary reactions, including radicals, possess great energy of activation ($E > RT_r$, where T_r is the temperature of the combustion). A more precise relationship can be obtained if the outlines for temperature and concentrations are found through approximated integration of heat conduction and diffusion. If it is assumed that the concentration of active centers in the zone of the reaction is constant, then it is possible to obtain the pattern of the temperature close to the temperature of combustion by disregarding the convective member in the equation of the heat conductivity in the same way as is done in the theory of heat propagation of a flame. A.W.

N64-21651 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
ON THE BURNING VELOCITY OF ATOMIZED FUEL
V. Ya. Basevich 17 Oct. 1962 14 p refs Transl. into ENGLISH from "Sgoraniye i Smeseobrazovaniye v Dizelyakh" Moscow, Izd. AK SSSR, 1960 p 10–18
(FTD-TT-62-1028/1+2+4; AD-292238)

The burning velocity of atomized fuel was measured using varying drop dimensions and turbulent flow velocities. Assuming the validity of the relationship: $D_0^2 - D^2 = k\tau$ where D is the drop diameter, D_0 the initial drop diameter, τ the combustion time, and k the combustion rate constant, values for k were determined for atomized kerosene along three trajectories. Comparisons were made with measurements done under more idealized conditions confirming the theory that the turbulence of the medium or of the burning zone cannot appreciably change the vaporization or burning rate of the fuel drops when $D \leq 100\mu$. D.S.G.

N64-21749 Picatinny Arsenal, Dover, N.J.
NITROCELLULOSE PAPER COMBUSTIBLE MANDRELS
Edward Daniels and David Eliezer Feb. 1964 18 p
(TM-1324; AD-431528)

Satisfactory combustible mandrels were fabricated by convolutely wrapping nitrocellulose paper on a cylindrical form using a lacquer to bond the layer of paper. A modified M8 JATO propellant grain was successfully cast around one of these mandrels and statically fired with satisfactory results. Author

N64-21785* National Aeronautics and Space Administration, Washington, D.C.
HIGH ENERGY PROPELLANTS. A CONTINUING BIBLIOGRAPHY, JANUARY 1962–MARCH 1964
1964 73 p refs
(NASA-SP-7002) OTS: $1.75

This bibliography presents a selection of annotated references to unclassified reports and journal articles on high-energy propellants. Prime emphasis is given to those references that are concerned with research and development studies on solid, liquid, and hybrid propellants and oxidizers, but the bibliography also provides extensive coverage of such related topics as propellant handling and storage, combustion characteristics, toxicity, and hazards and safety measures. Each entry in the bibliography consists of a citation and an abstract. A subject index is also included. N.E.A.

N64-21794 Army Missile Command, Huntsville, Ala. Propulsion Lab.
CURE STUDY OF "FLUID BALL" POWDER
Everette M. Pierce 3 Jan. 1964 15 p refs
(RK-TR-64-1; AD-431674)

A cure study of Fluid Ball powder and triethylene glycoldinitrate was conducted to determine the cure mechanism. The objective was to determine if all the ball powder was completely dissolved during the curing process or if most of the cure was by gelation. Experimental results showed that ball powder spheres were discrete after normal cure time and temperature. Author

N64-21815 Martin Co., Orlando, Fla.
EVALUATION OF THE MECHANISM OF CORROSION IN CAPILLARIES. OXIDIZER DIFFUSION STUDIES Status Report No. 1
P. J. Pizzolato and C. C. Fatino 4 Mar. 1964 8 p
(ME-531; AD-433622)

Analytical results to date are presented for diffusion studies on oxidizer–water systems. Results are presented for two mechanisms suggested as contributing to the leakage of the oxidizer, nitrogen tetroxide, from missile tanks. The mechanisms involve the generation of the corrosion medium nitric acid in defects such as cracks or pores in the tank wall or along the faying surfaces (i.e., between penetrating fasteners called huckbolts and the tank section). Estimation of diffusion coefficients for liquids is also discussed. N.E.A.

N64-21901 Rocketdyne, Canoga Park, Calif.
HYDROGEN OXYGEN CATALYTIC IGNITION
Charles Bendersky Jan. 1963 95 p refs
(RR-63-9)

The results of an experimental program for evaluating the feasibility of catalytic techniques for igniting hydrogen–oxygen propellant combinations are reported. Ignition capability at preignition environmental temperatures as low as −250° F was demonstrated at a mixture ratio of 1.0, and a mass velocity of ~4 lb/ft^2-sec. Reignition capability was demonstrated in a series of 15 reignitions conducted nominally at −260° F inlet

propellant temperature, ambient (~70° F) hardware, 1.0 mixture ratio, and mass velocity of ~3 lb/ft^2-sec. The program was conducted in 1-in.-diam hardware capable of about 10-lb thrust. Author

N64-22017* Beech Aircraft Corp., Boulder, Colo.
ELECTROTHERMAL ENGINE PROPELLANT STORAGE AND FEED SYSTEM STUDY, PHASE II
G. E. Roos, J. E. Bell, J. M. Lester, L. R. Dorman, H. E. Sutton, and B. H. Dean Washington, NASA, May 1964 177 p refs
(Contract NAS8-2574)
(NASA-CR-52) OTS: $3.00

Electrothermal thrustor propellant storage and feed systems are analyzed for hydrogen and ammonia. Design problems include insulation studies, structural concepts, zero-gravity studies, and flow metering and control investigations. These facets are studied independently at first and then combined to form complete storage and feed systems. The analysis of hydrogen storage, based on a specific mission profile, required most of the effort in this study. Author

N64-22129 Grumman Aircraft Engineering Corp., Bethpage, N.Y. Quality Control Dept.
RADIOISOTOPIC DETECTION OF MICROBIAL CONTAMINATION PRESENT IN JET FUEL
Dennis J. Becker and Edward A. Calvelli 1 Jun. 1963 20 p refs
(ADR-09-08a-63.1)

A radioisotopic method was developed for the rapid detection of microorganisms in jet fuel. Using this technique it is possible to reliably detect the presence of microorganisms within 1 hour after sampling, and semiquantitatively determine the degree of contamination within 2 to 3 hours. This method is readily adaptable to field operation, since the amount of radioactive material required does not necessitate special handling or AEC licensing. Author

N64-22190 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE PRODUCTION OF LIQUID OXYGEN USING AN AVERAGE PRESSURE SYSTEM WITH NITROGEN CIRCULATION
A. G. Golovintsov, M. B. Stolper, and A. M. Arkharov 19 Mar. 1963 13 p Transl. into ENGLISH from Khim. Mashinostr. (Moscow), no. 5, 1962 p 17–20
(FTD-TT-63-113/1+2+4; AD-410740)

Large-scale supercooling installations for the separation, in the form of liquids, of the components of air are discussed. Research was conducted on a supercooling cycle using nitrogen circulation and turbopumps. The cycle discussed produces complete separation of treated air in a single-column device without contamination of the oxygen by oil, does not require the special removal of carbon dioxide or drying of the treated air, and has good economical operation. The basic characteristics of the cycle are described, and the optimum values of the starting parameters are shown. P.V.E.

N64-22270 Aerojet-General Corp., Sacramento, Calif.
AGING CHARACTERISTICS OF MINUTEMAN POLYURETHANE BINDERS
V. D. Celentano May 1964 195 p refs
(Contract AF 33(600)-36610)
(AFBSD-TDR-64-52; AD-600881)

Results of aging and research investigations on polyurethane binders are reported. Emphasis was placed on the chemical reactions that occur in the binder structure during storage at elevated temperatures. Among the findings reported are: (1) The degradation of Minuteman Wing I and II ANP-2862 polyurethane binder aged at 180° F in air proceeds by oxidative attack on the polyether chains, followed by chain scission and chemical transformation of polyether chains to polyester–polyether chains. (2) The acid number, when correlated with mechanical property data, may prove a valid aging index of polyurethane-based propellants. (3) The selective extraction of sol fraction components was accomplished, and the solubility parameter concept proved useful in separating linear polyurethane components from unaged ANP-2862 binders. M.P.G.

N64-22395 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
VARIATION IN LENGTH OF THE COMBUSTION ZONE OF A HOMOGENEOUS MIXTURE IN A TURBULENT FLOW AS A FUNCTION OF PRESSURE
V. S. Pelevin 1 Feb. 1963 11 p refs Transl. into ENGLISH from Inzh.-fiz. Zh. (USSR), v. 5, no. 6, 1962 p 3–7
(FTD-TT-62-1744/1+2+4; AD-400551)

An investigation was made of the length of the combustion zone as a function of pressure (below atmospheric) during the burning of a homogeneous mixture in a turbulent flow. The experiments were conducted with the aid of a burner that used a mixture of air and grade B-70 gasoline. The results of two series of experiments are reported. For the first series, the amount of air supplied was constant and independent of the rarefaction in the pressure chamber. The concentration of fuel in the air mixture remained constant and was equal to 1.72%. For the second series, the amount of air supplied varied according to the variation in pressure. The fuel concentration remained constant and was the same as in the first series of experiments. R.T.K.

N64-22503 Harry Diamond Labs., Washington, D.C.
ANALYSIS AND DESIGN, ROTARY-TYPE SETBACK LEAF S & A MECHANISMS
William E. Ryan 11 Feb. 1964 116 p refs
(HDL-TR-1190; AD-439337)

A procedure is described for designing safety and arming setback mechanisms of the rotary-leaf and spring type to obtain optimum safety and reliability. An analytical study is made of the effect of varying the mass of the leaves upon the accidental drop safety of the mechanism. (The drop safety is defined as the absolute minimum velocity change that can possibly arm the device.) To determine whether the mechanism arms when fired, graphical curves are developed, showing the arming time of each leaf of different weight as a function of the time that elapses from the moment of firing to its release. By adding these arming times together, the combinations of weights that will arm are readily obtained. This study was made for both fast-and slow-rising acceleration curves, and for restraining springs with both flat and steep spring rates. The results of the analysis in each case indicate that leaves of equal weight are about as safe and reliable as combinations of leaves of varying weights. It was also discovered that the mechanism performed much as though a constant acceleration had been applied to it. Author

N64-22638 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FLAME STABILIZATION IN SURFACE LAYER
Stanislaw Wojcicki 14 Feb. 1963 15 p refs Transl. into ENGLISH from Arch. Budowy Maszyn (Warsaw), v. 9, no. 1, 1962 p 77–86
(FTD-TT-62-1821/1+2; AD-401446)

The purpose of this paper is to determine a generalized dependence for flame stabilization in the boundary layer, generated on the surface of a flat plate around which flows a stream of the fuel-and-air mixture. Author

27 PROPULSION

Includes airbreathing, electric, liquid, nuclear, and solid propulsion. *For related information see*: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N64-21540* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
TURBOJET AND TURBOFAN ENGINES FOR A MACH 3 SUPERSONIC TRANSPORT
James F. Dugan, Jr., Robert W. Koenig, John B. Whitlow, Jr., and Timothy B. Mc Auliffe N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964
(AIAA Paper-64-244) AIAA: $0.50 members, $1.00 nonmembers

The following types of gas turbine engines are discussed in connection with their suitability for powering Mach 3 supersonic transports: dry turbojets, afterburning turbojets, duct-burning nonmixed-flow turbofans, and afterburning mixed-flow turbofans. A Mach 3 transport with a fixed payload and powered by these various engines was flown on a 3,200-nmi mission. Engine weight reduction and high values of turbine inlet temperature resulted in lighter aircraft to carry the fixed payload. With each of the engine types, a payload equal to about 8% of takeoff gross weight (TOGW) was attainable. The gas turbine engines had engine thrust-to-weight ratios in the range 9.3 to 11.3 and operated at inlet temperatures in the range 2,300° to 2,500° F. Sonic booms below a certain level were unattainable; to lower the limiting value of sonic boom overpressure would require improvements in the propulsion system and/or the aircraft. A.W.

N64-21596 Itek Corp., Palo Alto, Calif. Vidya Div.
A STUDY OF SOLID-PROPELLANT ROCKET MOTOR EXPOSED MATERIALS BEHAVIOR Third Quarterly Progress Report, 1 Dec. 1963–29 Feb. 1964
John W. Schaefer, Raymond E. Lundberg, Robert M. Kendall, and Peter A. Mc Cuen [1964] 165 p refs
(Contract AF 04(611)-9073)
(RTD-TDR-64-43; AD-600593)

Work has been directed toward the development of two digital-computer programs. One of these is applicable to materials such as graphite and tungsten that, in general, erode with one moving boundary or do not erode at all. The other is applicable to the reinforced plastic materials that form a char layer. This development has required effort in the areas of transient conduction, equilibrium chemistry, reaction kinetics, and mass transport, as applied to the solid-propellant rocket problem, and this work is described in detail. Further, an arc-plasma generator rocket-simulation test program has been conducted to study the effects of chemical and mechanical erosion of several material types, and the results of 43 nozzle firings are reported. A second test program to investigate the erosive effects of Al_2O_3 particle impaction has been formulated, and the proposed test plan is described. Author

N64-21658 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
FOR AIRPLANES OF THE FUTURE
11 Mar. 1963 3 p Transl. into ENGLISH from Sov. Latv. (Riga), 3 Jul. 1962
(FTD-62-1751/1+4; AD-299631)

Ducted fan turbojet engines are discussed. Their advantages include fuel savings, VTOL and STOL applications, and payload capacities. The possibility of combining these engines with rocket propulsion for high-speed transportation is also mentioned. D.E.W.

N64-21706 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Institut für Triebwerksanlagen
THE MEASUREMENT OF QUICKLY-CHANGEABLE PRESSURES IN INTERNAL COMBUSTION ENGINES. PART II: INVESTIGATION OF CHARACTERISTICS OF ELECTRIC PRESSURE ABSORBERS UNDER STATIC LOAD [DIE MESSUNG SCHNELLVERANDERLICHER DRUCKE IN VERBRENNUNGSKRAFTMASCHINEN. TEIL II: UNTERSUCHUNG DER EIGENSCHAFTEN ELEKTRISCHER DRUCKAUFNEHMER UNTER STATISCHER BELASTUNG]
Ko Terada and Otto Kruggel Dec. 1963 70 p refs In GERMAN
(DFL-194) DFL: 12.00 DM

Various commercial, inductive and piezoelectric pressure gages were investigated as to their reaction under high-temperature conditions, in conjunction with the measurement of rapidly changing pressure in internal combustion engines. At equalized temperature levels, the gages were tested in the temperature range of 26° to 90° C as to their sensitivity stability under static loads, zero-point constant, and linearity of the calibration curve. Subsequently, in a special pressure apparatus, measurements were made to obtain the changes in sensitivity, under a constant calibration pressure of 60 atm, as a function of the ambient temperature of the threads of uncooled pressure gages up to 300° C and as a function of the heat flux density of the threads of cooled pressure gages up to about 300,000 kcal/m^2/hr. Transl. by I.v.L.

N64-21793 Air Force Systems Command, Wright-Patterson AFB, Ohio Aeronautical Systems Div.
CONTROLLED THERMONUCLEAR REACTIONS FOR SPACE PROPULSION
Robert F. Cooper and Richard L. Verga Sep. 1963 27 p refs Presented at the ASD Sci. and Eng. Symp.
(ASD-TDR-63-696; AD-432018)

A propulsion system utilizing controlled thermonuclear reactions as an energy source is shown to possess definite advantages over all other propulsion systems in the performance of those space missions requiring a high velocity increment. No valid argument exists that indicates that controlled fusion will not be achieved. In addition, analyses indicate that no insoluble engineering problems would be associated with the adaption of controlled fusion to the propulsion of a space vehicle. A number of applicable areas of technology are discussed. These areas are either being pursued at the present time or require additional intensive effort. Author

N64-21939 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRINCIPLES OF PROPELLANT APPLICATION IN LIQUID-PROPELLANT ROCKETS
N. N. Bobrov and P. I. Voropay 26 Mar. 1964 40 p Transl. into ENGLISH of Chapter 5 of a Book "Primeneniye Topliva i Smazochnykh Materialov" Moscow, Gostop, 1962 p 172–199
(FTD-TT-63-1063/1+2+4; AD-600523)

The discussion of the principles of propellant application in liquid-propellant rocket engines is divided into brief discussions of the following: (1) arrangement and operation of liquid rockets—thrust, specific thrust, specific propellant consumption, engine specific weight, actual-liquid rocket work cycle, relative efficiency, and internal efficiency; (2) cooling—external-flow cooling, internal cooling, and capacitive cooling; (3) methods of feeding propellants to the combustion chamber—pressure-tank feeding system and pump feeding system; (4) formation of propellant mixture and propellant combustion; (5) heat of combustion and gasification of liquid propellants; (6) liquid propellants—propellant requirements, monopropellants, bipropellants, oxidants, nitric acid, hydrogen peroxide, fuels, hydrocarbon fuels, amines, hydrazine and organic hydrazines, and metals and metal compounds; (7) effects of fuel and oxidant properties on propellant quality; and (8) promising energy sources for rocket engines. P.V.E.

N64-22002 Atomics International, Canoga Park, Calif.
STUDY OF SNAP POWER SYSTEMS IN THE LUNAR ENVIRONMENT, VOLUME I
W. O. Ackermann, R. E. Wimmer, W. B. Howard, and H. J. Kirk
1 Jul. 1963 144 p refs
(AI-8576)

The function of this report is to define the general conditions and constraints influencing reactor power systems on the moon, to determine the important design features necessary or desirable, and to focus attention on specific design parameters of practical interest. The following are discussed: (1) lunar environment and its influence on system design, installation, and performance; (2) lunar-mission power-system requirements; and (3) transportation. The report describes a hypothetical development sequence leading to the establishment of an 18-man permanent lunar base, and tabulates power requirements for the final base and for several key intermediate points in the development sequence. N.E.A.

N64-22068* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
SERT AND EARLY ELECTRIC PROPULSION SYSTEMS
J. Howard Childs and Ronald J. Cybulski Repr. from Astronautics and Aerospace Eng., May 1963 p 112–117 refs
(NASA-RP-190)

The several phases of the Space Electric Rocket Tests (SERT) program and early missions for electric propulsion systems are discussed. The main objectives of SERT are (1) to supplement vacuum-tank tests of electric thrustors and provide data on phenomena for which tank tests are inadequate or questionable; (2) to provide data on problems involved in the integration of thrustors with power supplies and flight vehicles; and (3) to qualify electric thrustors for mission applications. J.R.C.

N64-22069* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
SPACE POWERPLANT NEEDS AND SELECTION
D. T. Bernatowicz, D. C. Guentert, and J. L. Klann Repr. from Astronautics and Aerospace Eng., May 1963 p 22–26
(NASA-RP-192)

Criteria for evaluating and selecting space power systems usually include mass, ease of integration into the complete vehicle system, compatibility with the space environment, life and reliability, hazard to human life, cost, and availability or status of technology. These criteria are not ordered by importance but by decreasing amenability to engineering analysis. For this reason, preliminary survey of power systems are based on mass. J.R.C.

N64-22130 Stanford Research Inst., Menlo Park, Calif.
THE ROLE OF ALUMINUM AND ITS OXIDES AS SOURCES OR MODERATORS OF ELECTRONS IN SOLID PROPELLANT ROCKET EXHAUSTS Quarterly Status Report, Jul. 1–Sep. 30, 1963
G. Neil Spokes [1963] 28 p refs
(Contract AF 04(694)-128)
(SRI-5; AD-431259)

Studies have been made of the photoelectric properties of flame-treated Linde aluminum oxide and rocket exhaust particle samples. The materials exhibit similar properties. The thermionic work function of rocket exhaust particles is probably one or two tenths of an ev below the photoelectric value, 3.7 ev. Previous reports have primarily considered the role of particles as thermionic sources of electrons; attention is now turned to indirect processes such as surface ionization, surface recombination, and surface chemionization. Particle surface area per gram of particles and a parameter related to thermionic emission are estimated from published data about particle-size distributions. Author

N64-22139 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
IDEAL JET COMBINATION ENGINES
A. V. Kvasnikov 26 Nov. 1963 48 p Transl. into ENGLISH from the Book "Rabochiye Protsessy Teplovykh Dvigateley" Moscow, Gos. Nauchno-Tekhn. Izd. Oborongiz, 1962 p 5–47
(FTD-TT-63-864/1+2; AD-425606)

Theoretical parameters for a combination rocket–ramjet (SKD) are developed. An ideal engine is studied in which thermal, gas dynamic, and mechanical losses are considered. The thermal and power cycles of the SKD, the evaluation of the process in the mixing and compression chambers of the SKD, and the flight and altitude indices of a compressor-type SKD are discussed. P.V.E.

N64-22183 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SIMILARITY CONSIDERATIONS RESPECTING OPERATIONS BEHAVIOR OF JET PROPULSION UNITS
Von Gottfried Beckmann and Götz Bork 21 Aug. 1963 22 p refs Transl. into ENGLISH from Wiss. Z. Der Tech. Univ. Dresden (E. Germany), v. 11, no. 1, 1962 p 87–94
(FTD-TT-63-515/1+2; AD-428314)

This work covers a presentation of problems that arise in the treatment of thermodynamic operational behavior of turbojet engines. The central point of the considerations is a known similitude law—the similitude values that occur in the case of a fixed propulsion-nozzle end area can be presented generally as a function of the flight Mach number and the peripheral Mach number of the compressor. A constant level of the isentropic exponent and like consumption conditions for air and power for any special purposes are assumed. These requirements can be reduced in accordance with the practical needs. The application possibilities of this conformity to law are elucidated in an example in which the determination of a time–length flight characteristic is accomplished from measurement results that were obtained statically. N.E.A.

N64-22206 Flight Sciences Lab., Inc., Buffalo, N.Y.
A PARAMETRIC STUDY AND SURVEY OF THE THEORETICAL PERFORMANCE OF THE SUBSONIC COMBUSTION RAMJET
Benjamin Omilian Oct. 1963 84 p refs
(Contract AF 49(638)-1173)
(AFOSR-5351-1; AD-433723)

The subsonic combustion ramjet cycle is analyzed, and results are presented for the diffusion process, for the heat and

mass addition process, and for the expansion process, in terms of three performance parameters. These parameters—free-stream thrust coefficient, specific impulse, and a Breguet range parameter—are defined, calculated, presented, and discussed for hydrogen, ethylene, and pentaborane for use as fuels. Ramjet performance studies are surveyed, and a list of references is included. D.E.W.

N64-22230 Sundstrand Aviation-Denver, Denver, Colo.
EFFECT OF REYNOLDS NUMBER ON TURBINE PERFORMANCE AT VARIOUS MACH NUMBERS Final Report
Robert G. Adams and James E. Mullaney 13 Mar. 1964 131 p refs
(Contract NOw-61-0605-c)
(CDRD-64-7032; AD-433589)

Conclusions reached as a result of the investigation of the effect of Reynolds number of the efficiency of a turbine included the following: (1) The Reynolds number based on inlet relative velocity, rotor passage hydraulic diameter, rotor inlet viscosity, and density has a strong influence on the efficiency of axial and tangential flow turbines, producing, at Reynolds numbers of 800, an efficiency equal to approximately 75% of the value at a Reynolds number greater than 10^5. (2) Any interaction between Reynolds-number effect and Mach number is so small that it is impossible to measure with the methods currently in use. (3) The effect of Reynolds number on the performance of the tangential flow turbine is slightly different from that on the axial turbine. (4) The optimum pressure ratio split for two-stage reentry turbines is a strong function of specific speed, specific diameter, and second-stage Reynolds number, and a weak function of overall pressure ratio. P.V.E

N64-22238 Aerojet-General Corp., Sacramento, Calif.
EXPANDABLE NOZZLE ROCKET ENGINE DESIGN CONCEPT
5 Jun. 1964 31 p refs
(Rept.-8290-4S)

The expandable nozzle, which represents a new and unique approach to rocket design, has been successfully demonstrated at various sizes and operating conditions. Both metallic and nonmetallic expandable nozzles have been tested and evaluated. The metallic nozzle wall can be cooled by radiation, whereas the nonmetallic nozzle walls can be cooled by a combination of radiation, ablation, and heat-sink techniques. The expandable nozzle is a feasible concept for achieving a high area ratio for a rocket nozzle. This design is accomplished with minimum weight and high packaging efficiency without sacrificing performance. The actual selection of an expandable nozzle skirt depends upon the specific mission. It has been shown that an excellent application of the expandable nozzle is in upper stages and space vehicles where external ambient pressures are low or nonexistent. However, preliminary studies indicate the possibility of utilizing the expandable-nozzle concept for altitude compensation on booster stages. N.E.A.

N64-22252* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
POTENTIALITIES OF THE RADIOISOTOPE ELECTROSTATIC PROPULSION SYSTEM
William R. Mickelsen and Charles A. Low, Jr. [1963] 14 p Presented at the AIAA Elec. Propulsion Conf., Colorado Springs, Colo., 11–13 Mar. 1963
(AIAA Paper-63-048A)

Anticipated availability dictates the choice of cerium-144 as fuel for radioisotope electrostatic propulsion systems. With appropriate vehicle design, the gamma dosage can be acceptable for unmanned probe vehicles even without shielding. Good mission performance can be obtained with vehicles small enough for convenient mating with existing chemical boosters. Although launch-pad and boost-phase radiation hazards are serious problems, practical solutions may be possible. Manned interplanetary missions that require solar-flare absorption shielding appear to be feasible with this propulsion system. Author

N64-22274 Hercules Powder Co., Kenvil, N.J.
FEASIBILITY INVESTIGATION OF A HYBRID ROCKET FOR CREW ESCAPE CAPSULE APPLICATIONS Summary Report No. 1, Sep. 1961–Jun. 1962
A. J. Kavall Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Mar. 1964 58 p
(Contracts DA-36-034-ORD-3538-RD; AF 33(657)-2-R&D-111)
(FA-R-1715; FDL-TDR-64-31; AD-600691)

Thermodynamic calculations of various fuel-oxidizer combinations were performed on a computer so that optimum propellant systems could be formulated and investigated. Theoretical performance curves were plotted from the computer values. The fuels contained aluminum and magnesium powders in combination with four binder materials. The oxidizers considered were nitrogen tetroxide and red fuming nitric acid. Fuel formulations were selected and processed into sample mixes for laboratory scale testing and evaluation. Tests were conducted to ascertain the reactive properties of the fuel samples when sprayed with the candidate oxidizers. High-temperature storage testing was conducted on several sample fuels. A test motor was designed and fabricated to permit testing of full-sized fuel grains. Grain formulations containing 40% aluminum or magnesium with a Hycar binder system were fired in a "work horse" motor, and the results of these tests are included. R.T.K.

N64-22319 Aerospace Corp., El Segundo, Calif. Applied Mechanics Div.
PENETRATION DISTANCE OF RETROROCKET EXHAUST PLUMES INTO AN ONCOMING STREAM
S. E. Gilles and J. M. Kallis 11 May 1964 18 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-23; TDR-269(4181)-2; AD-600805)

A simple method for predicting the penetration distance of highly underexpanded retrorocket exhaust plumes into an oncoming free stream is developed and compared with experimental data. It is shown that the measured jet penetration distance and the standoff distance of the free stream bow shock wave are predicted closely by computing the plume flow field, using the method of characteristics for an axisymmetric plume exhausting into still air at a pressure equal to the oncoming free stream static pressure. The method is applied to a single jet and to a cluster of n identical jets. For the latter, the cluster is considered to be an equivalent single retrorocket having the same mass-flow rate (and thus an equivalent diameter $(n)^{1/2}$ times as large as the nozzle exit diameter of a single rocket). Author

N64-22330 Rocketdyne, Canoga Park, Calif.
DESIGN INFORMATION REPORT FOR THE ATLAS NA-3 PROPULSION SYSTEM
J. J. Griffin 31 Dec. 1963 188 p
(Contract AF 04(694)-328)
(R-1338-4; AD-426907)

A revised and updated description of the MA-3 propulsion system is presented. Included also are the system's performance, operating characteristics, weight and balance, mounting, propellant systems, electrical requirements, instrumentation, accessory provisions, handling, vents, drains, and purges.
M.P.G.

N64-22339 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COMBUSTION CHAMBERS OF AVIA TURBINE (TURBO) ENGINES (PART 2)
Jerzy Grzegorzewski 7 May 1963 23 p refs Transl. into ENGLISH from Tech. Lotnicza (Poland), no. 8, 1962 p 235–242
(FTD-TT-63-67/1+2; AD-408421)

Discussed is the construction of modern combustion chambers of avia turboengines. A schematic drawing is given on gas-dynamic calculations of a new chamber and a chamber planned on the basis of an existing sample. The requirements governing the material applied in the construction of combustion chambers are listed. Author

N64-22348 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STRUCTURAL ELEMENTS OF A LIQUID-FUEL ROCKET ENGINE
O. Drakulic 7 Jun. 1963 19 p Transl. into ENGLISH from Vojnctehn. Glas., (Yugoslavia), no. 3, 1962 p 200–208
(FTD-TT-63-346/1+2+3+4; AD-414753)

Structural elements of a rocket engine and its fuel system, which provide for efficiency of utilization, reliability, and precision of engine operation, are described P.V.E.

N64-22380 Picatinny Arsenal, Dover, N.J. Ammunition Engineering Directorate
EXPERIMENTAL STUDY OF LIQUID ROCKET SIMULATION OF SOLID PROPELLANT ROCKET EXHAUST CHARACTERISTICS
L. Jablansky and L. Stibrany Apr. 1964 45 p refs
(PA-TR-3165; AD-600938)

A substantial cost saving can be realized if a small liquid propellant rocket engine, using cheap propellants, can be used to screen nozzle materials for eventual use with large solid rocket motors using costly propellants. Work was completed in which the nozzle erosion experienced in a solid rocket motor using AHH propellant was simulated by a liquid propellant engine using white fuming nitric acid and benzene. The work was conducted at a one-to-one scale ratio, and the approach taken was to simulate erosion by simulating nozzle environment. Approximate simulation of nozzle erosion was achieved. Author

N64-22392 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INFLUENCE OF THE COMPRESSOR PROPERTIES ON THE TURBO-JET PROPULSION ENGINES CONSTRUCTION
M. Vujic 13 Jun. 1963 36 p refs. Transl. into ENGLISH from Tehnika (Belgrade), no. 2, 1961 p 267–275
(FTD-TT-62-1666/1+2; AD-414711)

An analysis of the influence of compressors on the construction of turbojet propulsion engines is discussed, and a comparison is made between axial- and centrifugal-type compressors. The discussion is divided into two sections: (1) choice and analysis of comparative factors and parameters—specific thrust, engine specific weight and (2) review of the achievements in turbojet propulsion engines with respect to the parameters investigated. P.V.E.

N64-22453* Thompson Ramo Wooldridge, Inc., Cleveland, Ohio Electromechanical Div.
TRANSVERSE FIELD ION ENGINE DEVELOPMENT Final Summary Report
W. N. Huss and A. C. Eckert Mar. 1964 84 p refs
(Contract NAS8-2527)
(NASA-CR-54054; TRW-ER-5847) OTS: $8.10 ph

A gaseous discharge possessing good ion-focusing properties was investigated and applied to the design of an ion source for electrical propulsion. An ion source was fabricated and has undergone initial performance-evaluation tests with both argon and mercury propellants. Tests of ion-source performance with a mercury propellant were made. The performance data were obtained with an ion source that used an accel–decel extraction system. Major efforts were made to solve the problems of ion-source efficiency, ion acceleration, and nickel-matrix dispenser cathodes. The transverse-field ion source appears useful in the space-propulsion application because of its excellent efficiency, high propellant utilization, and good lifetime potential. R.T.K.

N64-22465* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
TEMPERATURE-CONTROL ENGINEERING OF A NUCLEAR-ELECTRIC SPACECRAFT
John J. Volkoff N.Y. Am. Rocket Soc. [1962] 13 p refs Presented at the ARS Elec. Propulsion Conf., Berkeley, Calif., 14–16 Mar. 1962
(Contract NAS7-100)
(ARS Paper 2392-62)

A study is presented of the significance of system temperature in the design of spacecraft components and its effect on the overall performance and operational range of a nuclear-electric ion-propelled spacecraft. The systems integration philosophy and system components of a typical nuclear–electric spacecraft are discussed. A conceptual 70-kwe spacecraft configuration for an Earth-to-Venus deep-space mission is selected for this study. Expected operating steady-state temperatures of the spacecraft subsystems are examined. The nuclear-radiation shield design is briefly discussed with regard to system requirements, specifications, and configuration. The expected temperature gradients and a proposed method for cooling are surveyed. Major temperature-control problems of spacecraft subsystems and their interrelated effects are discussed. Environmental factors including solar, nuclear, and planetary thermal energies are shown to have considerable effect on component or system temperature. Suggested methods to lessen these effects and to prevent a component from approaching a critical operating condition are discussed.
Author

N64-22678* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL SYSTEMS STUDIES OF LARGE MODULES AND ARRAYS OF ELECTROSTATIC THRUSTORS
Paul D. Reader and William R. Mickelsen N.Y., AIAA [1964] 12 p refs Presented at the 1st AIAA Ann. Meeting, 29 Jun.–2 Jul. 1964
(AIAA Paper-64-503) AIAA: $0.50 members, $1.00 nonmembers

Performance characteristics and power requirements of existing electron-bombardment thrustors are presented in a form useful to electric-propulsion-system analysis and design. This information is based on experimental operation of laboratory thrustor modules of 5 to 50 cm in diameter and module and array power levels up to 30 kw. Designs are shown for two multidirectional nongimbaling thrustors of the size appropriate for satellite station keeping and attitude control. Static and dynamic controls characteristics of electron-bombardment

thrustors are summarized. A thrustor circuit design is described that suppresses electric breakdowns to a magnitude sufficiently small to eliminate damaging interaction between the thrustor and the power-conversion system. Author

N64-22721 Pratt and Whitney Aircraft, East Hartford, Conn.
RESEARCH AND DEVELOPMENT OF TITANIUM ROCKET MOTOR CASE Quarterly Report no. 13, 1 Jan.–31 Mar. 1964
H. A. Hauser and R. J. Makowski 30 Apr. 1964 9 p
(Contract DA-19-020-ORD-5230)
(PWA-2336; WAL-TR-766.2/1-15; AD-439417)

Design layouts of the full-scale case and the hydrostatic burst-test fixtures were completed. The case will be comprised of a forward closure, a cylindrical center section reinforced with circumferentially wound resin-bonded glass filament, and a rear closure. The closures will be machined from closed-die press forgings. The center section will be flow-turned from a roll-forged ring. The completed components will be joined by two girth welds made by a TIG welding process. The case is designed to burst at a pressure no lower than 3,000 psig and to resist buckling when subjected to a bending moment of 3,500,000 in.-lb and an axial compressive force of 600,000 lb. P.V.E.

28 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. *For related information see*: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N64-21614 Joint Publications Research Service, Washington, D.C.
INVESTIGATIONS OF THE NUCLEAR COMPONENT OF COSMIC RAYS MADE ON SOVIET SATELLITES AND ROCKETS
V. L. Ginzburg, L. V. Kurnosova, L. A. Razorenov, and M. I. Fradkin 10 Jun. 1964 103 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 82, no. 4, Apr. 1964 p 585–647
(JPRS-25029; OTS-64-31455) OTS: $2.50

Reported are investigations of the effect of the nuclear components of cosmic rays on Soviet artificial satellites and space rockets and the use of artificial satellites and rockets for investigation of primary cosmic radiation. In addition to a discussion of the experimental data, the problems and certain possibilities of study of cosmic rays beyond the limits of the atmosphere outside the earth's magnetic field are discussed. N.E.A.

N64-21633 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATIONS OF THE UPPER ATMOSPHERE WITH SATELLITES COSMOS-3 and COSMOS-5. 2: LOW-ENERGY PARTICLES
V. I. Krasovskiy, Yu. I. Gal'perin, N. V. Dzhordzhio, T. M. Mulyarchik, and A. D. Bolyunova *In its* Cosmic Res. 29 Oct. 1963 p 235–247 refs (See N64-21626 15-01)

This article gives the results obtained by charged-particle traps and fluorescent-screen electron indicators on the satellites Cosmos-III and Cosmos-V. Directed streams of positive ions were detected with an energy appreciably exceeding the thermal energy (apparently within the limits from tens of ev to several Kev). The ion flows reached $\sim 10^9$ ions per cm^2 sec steradian. These ions were recorded only at low altitudes in the F-region of the ionosphere. The fluorescent-screen indicators recorded electron streams of low energy with different anisotropy in the magnetic field. Electrons with energy less than 5 Kev were recorded primarily in the illuminated region of the atmosphere. The distribution of their velocity vectors is almost isotropic, and the intensity weakly depends on height. Electrons with energies of 5 to 50 Kev are detected primarily at high geomagnetic latitudes and at great heights, wherein their flow reaches $\sim 10^8$ electrons per cm^2 sec steradian. In addition, particles of appreciably higher energy with a distinct anisotropy were recorded, thus indicating that they were captured by the magnetic field. A comparison with the data of the traps indicates that these are electrons. Their omnidirectional flow reaches $5 \cdot 10^7$ electrons per cm^2 sec at altitudes of 1,000 km. Author

N64-21634 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
INVESTIGATIONS OF THE UPPER ATMOSPHERE WITH SATELLITES COSMOS-3 AND COSMOS-5. 3: HIGH-ENERGY PARTICLES
V. V. Temnyy *In its* Cosmic Res. 29 Oct. 1963 p 248–255 refs (See N64-21626 15-01)

Two regions about the earth were recorded by a shielded Geiger counter: the region of no captured particles, and the region of captured protons with an energy more than 50 Mev. The boundary of the capture region at heights less than 500 km is determined by atmospheric scattering; at greater heights it is located along the surface of an equal magnetic field strength B. Author

N64-21641 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
RADIATION MONITORING DURING THE FLIGHT OF VOSTOK-3 AND VOSTOK-4
I. A. Savenko, N. F. Pisarenko, P. I. Shavrin, and V. Ye. Nestrov *In its* Cosmic Res. 29 Oct. 1963 p 316–320 refs (See N64-21626 15-01)

The results of monitoring the radiation situation during the flight of the Vostok-III and Vostok-IV are described. The total doses of radiation received by the cosmonauts are given. Author

N64-21676 California Inst. of Tech., Pasadena
[HIGH ENERGY COSMIC RAYS AND SOLAR ACTIVITY] Final Report
Carl D. Anderson, H. Victor Neher, R. B. Leighton, and E. W. Cowan [1964] 11 p refs
(Contract Nonr-220(17))
(AD-431599)

Cloud chamber research was used to investigate very high energy particles in the range 10^{11} to 10^{14} ev, which are beyond the range of any present machines. About 3,000 photographs were obtained. In research on primary cosmic rays, the program was expanded to include measurement of cosmic rays in space using instrumentation carried by Mariner II; the latter made it possible to establish a definite value for the cosmic ray albedo of the atmosphere at the pole and to measure the change of cosmic rays with distance from the sun. A magnetic field mapping system used to obtain a pictorial map of the solar surface velocity fields led to the discovery of an oscillatory motion having a period of 5 minutes and a system of large-scale horizontal currents. A.W.

N64-21684 Purdue U., Lafayette, Ind. School of Aeronautical and Engineering Sciences

MAGNETIC FIELDS IN STELLAR PROBLEMS. A REVIEW

C. P. Yu Aug. 1963 42 p refs

(Grant NSF-GP-927)

(A&ES-63-9)

A review is given on the theoretical work in the field of stellar magnetism. Four outstanding problems are considered: (1) the origin of magnetic fields; (2) the theory of magnetic variables; (3) the magnetic effect in stellar equilibrium; and (4) the magnetic effect in stellar evolution. A survey of these problems illustrates the difficulties encountered in the present theories. Author

N64-21755 Sacramento Peak Observatory, Sunspot, N. Mex. Office of Aerospace Research

ON THE RADIO AND X-RAY EMISSION OF SOLAR FLARES

A. K. Pankratov [1963] 18 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), 29, 1963 p 160–173 173

(SRN-50; AD-432274)

Data on f_{min} radio emission and solar flares, collected during the IGY and IGC by observatories and stations, were used. The connection between X-ray emission and the emission in Hα of flares is studied statistically. Six intense chromospheric flares (importance 3 and 3+) not accompanied by X-ray emission ($\lambda \leq 8$ A) were detected and also eight "double" flares that generated X-ray emission only in one knot or maximum. The absence of a directivity effect in the X-ray emission of flares is established. All type IV bursts of radio emission are accompanied by an appreciable flow of X-ray emission, sufficient for the appearance of a well noticeable (according to f_{min}) additional ionization of the D layer. The possibility of a unique relation between the presence of X-ray emission of solar flares and type IV bursts of radio emission is discussed briefly. Several intense ionospheric effects (in the D layer) are due to the X-ray emission from behind-the-limb flares, which are seen from the earth as subflares or not at all. This fact is apparently evidence that the region of generation of X-ray emission is not limited by the region of flare emission in Hα but extends to heights of several tens of thousands of kilometers into the region of coronal condensations. Author

N64-21905 Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.

MAGNETIC FIELDS IN THE OUTER SOLAR ATMOSPHERE

Ludvig Oster Mar. 1963 90 p refs

(DI-82-0216)

On the basis of recent observations, simple mathematical models representing the magnetic field distribution in photospheric layers of the sun are proposed. The structure of the resulting fields in the outer atmosphere and, in particular, the behavior of neutral points are discussed. The expected trapping of charged particles is compared with relevant observations. Author

N64-22012 Brazil Commissao Nacional de Atividades Espaciais

EFFECTS OF SOLAR RADIO BURST ON RIOMETER RECORDS AT 30 Mc/s

S. M. Radicella and M. A. Sette Mar. 1964 13 p refs

(LAFE-11)

An attempt was made to establish a correlation between observed bursts at Boulder, Colorado, on the range of 8 to 41 mc/s and riometer records at São José dos Campos, Brazil, at 30 mc/s. Fourteen cases of type III burst were analyzed to determine the correlation coefficient between the logarithm of the power arriving at the antenna due to the burst and the secant of the solar zenith angle X. The coefficient $r = -0.91$ shows the influence of the optical depth of the lower level of the ionosphere (and possible antenna beamwidth) on the received power during the burst. The estimated flux density for the solar radiation is in very good agreement with the limits observed at Boulder. An example is presented of interesting features of events, such as flares and intense associated bursts of type II, III, IV, and continuum as shown on the riometer records. Author

N64-22030 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

ON THE DENSITY DISTRIBUTION AND INTENSITY OF CHARGED PARTICLES WITHOUT TAKING INTO ACCOUNT INTERACTION IN A STATIONARY GEOMAGNETIC FIELD

V. D. Pletnev *In its* Cosmic Res. 14 Feb. 1964 p 110–127 refs (See N64-22027 15-29)

An asymptotic method of solving the Boltzmann equation for a low-density ionized gas in a strong stationary magnetic field is used to estimate the density distribution and intensity of charged particles in the Van Allen radiation belts. This method, previously developed and based on expansion of the distribution function of charged particles with respect to the inverse powers of the Larmor frequency, is applicable when conserving the invariant of the longitudinal effect of a particle in a magnetic field. For this, additional averaging of the distribution function is carried out for the period of vibrations of a particle between magnetic mirrors. This work examines the different possible forms of the distribution function in these approximations and their corresponding density distributions and intensity of charged particles in the field. Author

N64-22032 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

INVESTIGATIONS OF COSMIC RADIATION BEYOND THE ATMOSPHERE

N. L. Grigorov, D. A. Zhuravlev, M. A. Kondrat'eva, I. D. Rapoport, and I. A. Savenko *In its* Cosmic Res. 14 Feb. 1964 p 163–176 refs (See N64-22027 15-29)

Measurements of the tracks of charged particles in an emulsion irradiated at a height of 306 to 339 km showed that the intensity of the recorded radiation is three times greater than the intensity of primary cosmic radiation. Nearly 50% of the excess particles were nonnuclear active particles with minimum ionization (electrons are the fastest). The remaining 50% are strongly ionized particles, which are nuclear fission products. Author

N64-22033 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

OUTGOING RADIANT FLUXES ONTO VARIOUSLY ORIENTED SURFACES AT A HEIGHT OF 300 km

K. Y. Kondrat'yev and M. N. Fedorova *In its* Cosmic Res. 14 Feb. 1964 p 177–185 refs (See N64-22027 15-29)

This article gives the results of calculating outgoing long-wave and short-wave radiant fluxes onto variously oriented plane surfaces at a height of 300 km. The calculations were made from the angular distribution of the intensity of the outgoing radiation. Conclusions were reached on the feasibility of using an isotropic approximation for calculating the outgoing long-wave radiation. Author

N64-22034 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
BALLOON INVESTIGATIONS OF THE RADIATION BALANCE OF THE EARTH'S SURFACE-ATMOSPHERE SYSTEM
K. Ya. Kondrat'yev, G. N. Gavvskaya, and G. A. Nikol'skiy *In its* Cosmic Res. 14 Feb. 1964 p 186–203 refs (See N64-22027 15-29)

This article considers the vertical profiles of the radiation balance and its components, during the summer and fall, measured by standard actinometric devices mounted on free balloons. Author

N64-22299 Oslo U., Blindern (Norway) Inst. of Theoretical Astrophysics
RESEARCHES IN THE FIELD OF SOLAR RADIO NOISE AND SUNSPOT STRUCTURE Technical Final Report, 1 Jan. 1959–31 Dec. 1963
Svein Rosseland 10 Feb. 1964 34 p refs
(Contract AF 61(052)-186)
(AFCRL-64-335; AD-600896)

This is a comprehensive report on sunspot statistics, and observations and theories concerning the physical structure of sunspots, prominences, and the corona. Author

N64-22340 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
IONIZED GAS AND FAST ELECTRONS IN THE VICINITY OF THE EARTH AND IN INTERPLANETARY SPACE
K. I. Gringauz, W. G. Kurt, W. I. Moroz et al 22 Apr. 1963 9 p refs Transl. into ENGLISH from Astronautyka (Poland), no. 3, 1961 p 8–10
(FTD-TT-63-69/1+2; AD-405790)

On the basis of data obtained from the second Soviet cosmic rocket, the following conclusions are presented: (1) Streams of electrons with energies over 200 ev in the zone of the outer radiation belt do not exceed 2×10^7 $cm^{-2}sec^{-1}$. (2) In the zone 50,000 to 70,000 km from the earth, electron streams with energies $E > 200$ ev $N_e \approx 10^{-8} - 2 \times 10^8$ cm^{-2} sec^{-1} exist. (3) The existence in the geocorona of a third, outermost belt or shell consisting of electrons of relatively low energy is indicated. (4) The polarized component of zodiacal light is due to dispersion of solar light by dust particles and not by free electrons. M.P.G.

N64-22436* California U., San Diego
GAMMA RAYS IN SPACE, RANGER 3
James R. Arnold, Albert E. Metzger (JPL), Ernest C. Anderson, and Marvin A. Van Dilla (Los Alamos Scientific Lab.) Repr. from J. Geophys. Res., v. 67, no. 12, Nov. 1962 p 4878–4880 refs
(Grant NsG-97-60)

Results from an instrument designed to measure gamma radiation coming from the surface of the moon are presented. Observations of the interplanetary gamma-ray flux and suitable background measurements for lunar analysis are discussed. A brief description of the gamma-ray spectrometer, which was carried on the Ranger III, is given. N.E.A.

N64-22458* Johns Hopkins U., Baltimore, Md.
FAR U. V. DAYGLOW MEASUREMENTS: ATOMIC OXYGEN
William G. Fastie and H. M. Crosswhite Jun. 1964 11 p refs Presented at the 5th COSPAR Intern. Space Sci. Symp., Florence, 14 May 1964 Submitted for Publication
(Grant NsG-193-62)
(NASA-CR-56361; TR-6)
OTS: $1.60 ph

An experiment designed to obtain information about the radiative transfer process in atomic oxygen is discussed. The instrumentation used in the experiment are described, and data from two flights are presented in graphic form. P.V.E.

N64-22676* National Aeronautics and Space Administration, Washington, D.C.
THE SPECTRAL DISTRIBUTION OF OUTGOING RADIATION [K VOPROSU O SPEKTRAL'NOM RASPREDELENII UKHODYASHCHEGO IZLUCHENIYA]
K. Ya. Kondrat'yev and K. Ye. Yakushevskaya Washington, NASA, Jun. 1964 23 p refs Transl. into ENGLISH from Probl. Fiz. Atm. Sb. 2, Izd. Leningr. Univ., (USSR), 1963 p 48–66
(NASA-TT-F-210) OTS: $0.75

In some problems, the intensity of outgoing radiation and the distribution of this intensity over the spectrum are of interest. To obtain data of this sort, the intensities of outgoing radiation were calculated at the nadir in 27 spectral sectors of the 1μ to 18μ range. In the 1μ to 12μ interval, the intensity was also obtained for the zenith angle $\theta = 30°$. The calculations are based predominantly on the most recent experimental data concerning the absorption of long-wave radiation by water vapor, carbon dioxide, and ozone. Author

29 SPACE SCIENCES

Includes space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories. *For space biology see*: 16 Life Sciences. *For related information see*: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N64-21627 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DETERMINATION OF THE PARAMETERS OF MOTION OF A SPACE VEHICLE USING TRAJECTORY-MEASUREMENT DATA
E. L. Akim and T. M. Eneyev *In its* Cosmic Res. 29 Oct. 1963 p 3–81 refs (See N64-21626 15-01)

A method is given for determining the parameters of motion of a space vehicle from trajectory-measurement data. Also given is the algorithm for estimating the accuracy of predicting the motion of the vehicle from the results of the reduction of trajectory measurements. The method is adaptable for use with general-purpose high-speed computers. Author

N64-21628 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SOLUTION OF THE EULER–LAMBERT EQUATION FOR FLIGHT ORBITS CLOSE TO THE HOHMANN ORBITS
M. S. Yarov-yarovoy *In its* Cosmic Res. 29 Oct. 1963 p 82–88 refs (See N64-21626 15-01)

A new, rapidly converging expansion of the right side of the Euler–Lambert equation for flight close to Hohmann orbital flight was obtained. The use of this expansion increases the rapidity of convergence of the iterations when it is solved for a broad range of flight orbits. In connection with the launchings of artificial space vehicles to other planets, a great interest in the study of flight trajectories along imperturbed orbits between the departure point and the destination point exists, since many characteristics of flight along a perturbed orbit are

determined by the properties of unperturbed bits. Various methods can be used to solve this problem. For example, one article gives a table of unperturbed orbits for flight between the orbits of Earth and Venus. Such a table makes it possible to make many qualitative deductions difficult to obtain by analytic methods. The usual method of determining orbital elements by means of two heliocentric positions can also be used. The basic difficulty is in finding a solution to the Euler–Lambert equation. Author

N64-21639 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRELIMINARY RESULTS OF THE INVESTIGATION OF METEORIC MATTER ALONG THE FLIGHT TRAJECTORY OF THE MARS-1 INTERPLANETARY STATION
T. N. Nazarova, A. K. Bektabegov, and O. D. Komissarov *In its* Cosmic Res. 29 Oct. 1963 p 302–307 (See N64-21626 15-01)

The investigation of meteoric matter on the Mars-1 interplanetary station was carried out by piezoelectric transducers. The area sensitive to the impact of meteoric particles was 1.5 m^2. On November 1, 1962, the station intersected the Taurid stream. At a distance from 6,600 to 42,000 km, the average frequency of impacts by meteoric particles on the sensing surface was $7 \cdot 10^{-3}/cm^2$ sec. The space density of the meteor stream was extremely uneven. From December 31, 1962, through January 30, 1963, at a distance of 23 to 45 million km from the earth, the station again encountered a meteor stream that has still not been identified with any meteor stream known on the earth. This meteor stream, based on the average space density of particles in it and on the distribution of matter in the stream, is similar to the Taurids. The average frequency of impact was $4.5 \cdot 10^{-3}/m^2$ sec. Author

N64-21640 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE RADIATION SITUATION IN SPACE ON THE EVE OF THE FLIGHT OF VOSTOK-3 AND VOSTOK-4
I. A. Savenko, P. I. Shavrin, V. Ye. Nesterov, N. F. Pisarenko, and M. V. Tel'tsov *In its* Cosmic Res. 29 Oct. 1963 p 308–315 refs (See N64-21626 15-01)

The results are given of the radiometric measurements carried out on Cosmos-IV and Cosmos-VII. A brief description of the installed apparatus is given. Author

N64-21659 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE PATH TO MARS
A. Shternfel'd 28 Jan. 1963 7 p Transl. into ENGLISH from Sov. Rossiya (USSR), 3 Nov. 1962
(FTD-TT-63-93/1+2+4; AD-299629)

The conditions necessary for a successful flight from Earth to Mars are considered: time, orbit, trajectory, fuel expenditure, velocity, and duration. A.W.

N64-21679 Mitre Corp., Bedford, Mass.
A BRIEF SURVEY OF SATELLITE ORBIT COMPUTATION METHODS AND MAJOR PERTURBATIVE EFFECTS
R. H. Greene Mar. 1964 53 p refs
(Contract AF 19(628)-2390)
(ESD-TDR-63-477; TM-3641; AD-434348)

A brief descriptive survey of the various satellite orbit computation methods is presented here to give the systems engineer an introduction to the various methods and problems currently existing. Author

N64-21692 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
AN EMPIRICAL TECHNIQUE FOR IMPROVING AEROBEE-HI IMPACT PREDICTIONS
Gordon L. Dunaway May 1964 17 p refs
(ERDA-138; AD-439451)

An empirical technique is presented for the improvement of Aerobee-Hi impact predictions. The variables used in the prediction equations are the theoretical wind displacements from the surface to 2,000 feet and from 2,000 to 100,000 feet. The results are presented in tabular form. Author

N64-21791 General Electric Co., Philadelphia, Pa. Space Sciences Lab.
AN APPROXIMATE METHOD FOR OPTICAL TRAJECTORY REDUCTION White Sands Missile Range Special Report
R. F. Hughes 10 Dec. 1963 17 p refs
(Contract AF 04(694)-222; Proj. Trap)
(R63SD1045; AD-434270)

The basic data consist of a night-time trajectory photograph, trajectory timing, and the impact point. An inexpensive aerial camera suffices for the optical data. Background stars define a coordinate system by which the angular trajectory relative to the observing station can be determined. The angular measurements plus an approximate trajectory plane orientation define the position coordinates. For short ranges, the impact and launch points fix a possible trajectory plane. A reduction is given of a vehicle reentry trajectory at the White Sands Missile Range. The resultant slant ranges are necessary to compute radiation intensities at the source from the observed intensities at the observing station. The errors introduced in the intrinsic intensities by the approximate trajectory were less than 5%. The time required for determination of the approximate trajectory exclusive of intensity reductions is only 1 or 2 days. Author

N64-21813 Grumman Aircraft Engineering Corp., Bethpage, N.Y.
OLD AND NEW LUNAR PHOTOMETRIC MODELS AND WHAT THEY MEAN
J. D. Halajian Apr. 1964 33 p refs Presented at the Meeting of the Environment and Resources Subgroup, Comm. of Extraterrest. Resources, Golden, Colo., Apr. 1964
(ADR-04-04-64-1)

Previous attempts at inferring the nature of the lunar surface from its photometric properties and the limitations of experimental techniques used are assessed in the light of new model-matching experiments performed with an improved photometer. A number of new successful models consisting of powdered or coherent materials are reported. It is concluded that: (1) Any final conclusion regarding the consistency, bearing strength, chemical composition, and absolute roughness of the lunar surface layer on the basis of its photometry alone is unjustified. (2) The surface of the moon, whatever its origin, is covered with a dark, highly porous material having interconnected cavities. (3) An underdense rigid silicate promises to reconcile the photometric and infrared portions of the lunar data better than a loose fluff. Author

N64-21838* Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
OPTIMAL MULTISTAGE ROCKET FLIGHT AND OTHER DISCONTINUOUS VARIATIONAL PROBLEMS
H. Gardner Moyer Jul. 1963 31 p refs
(Contracts NAS8-1549; AF 49(638)-1207)
(RN-162)

Variational problems characterized by discontinuities artificially introduced by the problem formulation are examined. The discontinuities apply not only to the parameters in the differential equations of constraint but also to the state variables themselves. Two approaches to these problems are presented. The optimal flight of a throttleable, multistage rocket is discussed extensively. Author

N64-21870 Joint Publications Research Service, Washington, D.C.
AFTER A LONG DISTANCE —A LONG DISTANCE
V. I. Yazdovskiy *In its* Space Biol. and Medicine 1964 p 42–49 (See N64-21866 15-16) OTS: $1.25

The problems of interstellar travel are discussed. Particular problems include propulsion, travel time, and collisions with dust particles and hydrogen atoms. P.V.E.

N64-22027 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
COSMIC RESEARCH, VOLUME NR. 1, ISSUE NR. 3, 1963
14 Feb. 1964 249 p refs Transl. into ENGLISH of Kosmich. Issled. Moscow, Izd. Akad. Nauk SSSR, 1963 v. 1, issue 3 p 339–480
(FTD-TT-64-90/1+2+4; AD-432005)

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6. OUTGOING RADIANT FLUXES ONTO VARIOUSLY ORIENTED SURFACES AT A HEIGHT OF 300 km K. Ya. Kondrat'yev and M. N. Fedorova p 177–185 refs (See N64-22033 15-28)
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N64-22028 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE EVOLUTION OF THE ROTATION OF A DYNAMICALLY SYMMETRICAL SATELLITE
V. V. Beletskiy *In its* Cosmic Res. 14 Feb. 1964 p 1–79 refs (See N64-22027 15-29)

A complete system of equations in osculating elements for describing the rotational motion of a dynamically symmetrical satellite is proposed. The use of averaging with respect to one or two fast variables reduces the complete system of equations to simpler equations; in a number of important cases the averaged system can be integrated to completion in closed form. The theory thus formulated is used to investigate motion under the action of moments of gravitational, aerodynamic, and magnetic forces and of the forces of light pressure, aerodynamic dissipation, and Foucault currents. Author

N64-22035 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE VALUE OF GEOGRAPHIC-GEOLOGICAL METHODS OF STUDYING THE MOON
Yu. A. Khodak, V. V. Kozlov, I. N. Tomson, and L. V. Khoroshilov *In its* Cosmic Res. 14 Feb. 1964 p 204–215 refs (See N64-22027 15-29)

The value of geographic–geophysical methods of studying the moon, especially structural–geomorphological and structural–historical-geological methods, is substantiated. It is proposed that there is a close connection between geographic-geological (with regard to material comparable to the earth) and astronomical methods in the study of the moon. An evaluation is made of the geographic–geological studies already completed in the U.S.S.R. and in other countries and also of the meteoritic approach to explaining the development of the relief and structure of the moon. Author

N64-22036 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAIN STRUCTURAL ELEMENTS OF THE MOON
Yu. A. Khodak *In its* Cosmic Res. 14 Feb. 1964 p 216–227 refs (See N64-22027 15-29)

A description is given of the main structural elements of the near and far sides of the moon, and a series of deep-fracture zones in four directions, which segment the lunar crust into huge blocks, is noted. Author

N64-22037 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
DISCUSSION OF SPACE RESEARCH PROBLEMS AT THE XIV GENERAL ASSEMBLY OF THE URSI
K. I. Gringauz *In its* Cosmic Res. 14 Feb. 1964 p 228–245 Assembly held in Tokyo, 9–20 Sep. 1963 (See N64-22027 15-29)

Papers presented in the following areas are discussed: satellites and rocket investigations of ionospheric structure including the D- and E-regions, both in the presence and absence of disturbances; solar-radiation intensity in the lower ionosphere; electron- and ion-concentration measurements above the main ionization maximum; measurements of the electron temperature; and determination of ion composition and upper ionospheric radiosoundings (above the ionization maximum). R.T.K.

N64-22063* Cornell U., Ithaca, N.Y. Center for Radiophysics and Space Research
A THEORETICAL PHOTOMETRIC FUNCTION FOR THE LUNAR SURFACE
Bruce W. Hapke Repr. from J. Geophys. Res., v. 68, no. 15, 1 Aug. 1963 p 4571–4586 refs
(Grant NsG-119-61)

A formula describing the observed photometric properties of the lunar surface is derived theoretically. Functions for

both the differential and integral brightness are obtained. The model surface on which the derivation is based consists of a semi-infinite, porous layer of randomly placed obscuring objects suspended in depth in such a way that the interstices separating them are interconnected. A layer of fine, loosely compacted dust is in the category of surfaces described by this model, but volcanic foam is not. The shape of the photometric curve depends on the fractional void volume. Bulk densities of the order of one-tenth that of solid rock are implied for the upper layers of the surface of the moon. Author

N64-22076* Geophysics Corp. of America Bedford, Mass.
A THEORETICAL ESTIMATE OF THE AVERAGE VERTICAL DISTRIBUTION OF TEMPERATURE IN THE MARTIAN ATMOSPHERE
George Ohring Repr. from Icarus, v. 1, no. 4, Jan. 1963 p 328–333 refs
(Contract NASw-704)
(GCA-TR-62-7-N)

The average variation of temperature with height in the Martian atmosphere is probably controlled by radiative and convective processes. With the use of a simple theoretical formulation in which it is assumed that convection will extend to that height above which the radiative equilibrium lapse rate is just stable, the average temperature profile is computed. It is assumed that the average surface temperature is 230° K, that there is no absorption of solar radiation in the atmosphere, and that carbon dioxide in an amount equal to 2% by volume is the only important radiating gas. The radiation fluxes are computed with the aid of radiation tables; the radiative equilibrium temperatures are calculated using an iterative procedure. The computed temperature profile is characterized by an adiabatic troposphere extending to about 9 km, above which the temperature continues to decrease with height to an average value of about 90° K for the topmost 5-mb layer. Author

N64-22079* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
SUPERNOVAE, NEUTRINOS, AND NEUTRON STARS
H. Y. Chiu Repr. from Ann. Phys., v. 26, no. 3, Feb. 1964 p 364–410 refs

In this paper, the final evolution of a presupernova star is reviewed. It seems inevitable that the star will end up as a neutron star with a radius of around 10 cm and a surface temperature of around 10^8 to 10^{7}° K. A critical mass limit exists for neutron stars. Beyond this mass limit, no static structure is possible. Neutron stars can be detected only by extraterrestrial X-ray telescopes. If detected, they pose interesting questions on our present theory of fundamental particles. N.E.A.

N64-22080* Canterbury U., Christchurch (N. Zealand)
THE DISTRIBUTION OF METEORS AROUND THE EARTH'S ORBIT
C. S. L. Keay Repr. from Monthly Notices of the Royal Astron. Soc., v. 126, no. 2, 1963 p 165–176 refs
(Grant NsG-219-62; Contract AF 64(500)-6)

As a result of 69.5 mc radar survey of meteoric activity recently undertaken in New Zealand, the variation of incident flux with solar longitude has been determined. It has been confirmed that the spatial density of small-size (sixth magnitude) meteoric matter is greater along the earth's orbit during the latter half of the year. However the comparison of results from both hemispheres shows that at midlatitude observing stations this asymmetry has a smaller influence than the gyrations of the ecliptic on the seasonal variation in observed meteor rate. These effects taken together provide a satisfactory explanation for most of the differences between the results from the two hemispheres. Author

N64-22090* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVOLUTION WITH NEUTRINO LOSS OF A MASSIVE STAR UNTIL THE ONSET OF CARBON BURNING
Chushiro Hayashi and Robert C. Cameron Repr. from Astron. J., v. 69, no. 2, Mar. 1964 1 p refs
(NASA-RP-189)

The neutrino loss effect after the formation of a carbon-oxygen core was studied in detail by constructing a contracting-core model sequence. The hydrogen-rich envelope and a helium zone are neglected, and the core is treated as a single star of 2.6 solar masses. As the contraction proceeds, a central isothermal core appears; its mass grows because of the rather high temperature dependence of the neutrino-loss rate. In the outer zone of lower temperature, the energy release (radiation loss) is due mainly to gravitational contraction, with the rate proportional to the temperature. Fitting of the core and outer zone (accomplished by equating neutrino and radiation loss rates) shows that electron degeneracy sets in at the center when the mass of the core becomes about one-half solar mass; subsequently, the degenerate region grows somewhat rapidly with increasing temperature and density. When the core mass becomes about one solar mass, both the central density and temperature become high enough for the carbon flash to occur. P.V.E.

N64-22091* Massachusetts Inst. of Tech., Cambridge Research Lab. of Electronics
OBSERVATIONS OF VENUS, THE SUN, MOON, AND TAU A AT 1.18-cm WAVELENGTH
D. H. Staelin, A. H. Barrett, and B. R. Kusse Repr. from Astron. J., v. 69, no. 1, Feb. 1964 p 69–71 refs
(Contract NASr-101; Grant NsG-419)

The average brightness temperature of Venus as determined by 94 drift curves and 42 on–off measurements was 395° K (+75°, −55°). Twenty drift curves of Tau A give a flux density of $(295 \pm 85) \times 10^{-26}$ webers m^{-2} cps^{-1} when a disk of uniform brightness is assumed that is 3.6 min in diameter. The brightness temperature of the sun was determined to be 8,870° ± 980° K, and the observations of the moon yielded brightness temperatures for the center of the moon 240° ±40° K 3.5 days before full moon, 254° ±30° K 0.3 day before full moon, and 254° ±30° K 1.8 days after full moon. The typical zenith attenuation encountered was 0.2 db, determined by observations of the sun and the sky-brightness temperature. The antenna gain, 64.6 ±0.5 db, was determined by scaling the gain measured at 35.2 Gc/sec and by measurements of the beam shape, sidelobe level, and magnitude determined from the solar and lunar data. Author

N64-22320 Aerospace Corp., El Segundo, Calif. Astrodynamics Dept.
LAUNCH WINDOWS FOR ORBITAL MISSIONS
A. H. Milstead 1 Apr. 1964 34 p
(Contract AF 04(695)-269)
(SSD-TDR-64-31; TDR-269(4550-10)-6; AD-601072)

The launch window is defined as the time span around the nominal launch time during which the vehicle may be launched and the target plane achieved within a specified additional ideal velocity budget. This paper presents analytical formulations for the launch window as functions of the additional ΔV budget and other parameters for fixed and for variable launch azimuths. The effect of launch azimuth constraints (e.g., for range safety) on the launch window is investigated, and several related problems are discussed. Author

N64-22361 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTOUR OF LUNAR BOUNDARY ZONE
A. A. Gorynya and V. K. Drofa 5 Dec. 1963 12 p Transl. into ENGLISH from Rel'ef Krayevoy Zony Luny, Izd. An Ukr. SSSR, Glavnaya Astron. Observ., (Kiev), 1962 p 1–8
(FTD-TT-63-982/1+2; AD-426673)

Reported is a study of lunar circumference deviation values. The deviation of the real edge from the most probable circumference representing the contour of the visible lunar disk is investigated. The investigation entailed measuring photos, scale determinations of plates, refraction corrections, and calculation of radii of most probable circumferences that represents visible disks of the moon, and determination of deviation of real edge. N.E.A.

N64-22366* Massachusetts Inst. of Tech., Cambridge Res. Lab. of Electron.
MICROWAVE DETECTION OF OH IN THE INTERSTELLAR MEDIUM
A. H. Barrett, M. L. Meeks, and S. Weinreb Repr. from Astron. J., v. 69, no. 2, Mar. 1964 1 p
(Grant NsG-419)

Spectral observations revealed the presence of the 18-cm lines of the hydroxyl (OH) radical in absorption in the direction of the Cassiopeia A radio source. The H-line observations show absorbing clouds in the direction of Cas A with radial velocities of −0.8, −38.1, and −48.2 km/sec. The OH observations also show absorption at frequencies corresponding to radial velocities of −0.8 and −48.2 kc/sec for both the 1,665 and 1,667 mc/sec lines; the OH lines disappeared when the antenna beam was positioned off Cas A, and the lines moved 20 kc/sec between 17 October and 29 October, in agreement with the shift expected from the orbital velocity of the earth during this period. R.T.K.

N64-22368* Cornell U., Ithaca, N.Y. Center for Radiophysics and Space Research
A THEORETICAL PHOTOMETRIC FUNCTION FOR THE LUNAR SURFACE
Bruce W. Hapke Repr. from J. Geophys. Res., v. 68, no. 15, 1 Aug. 1963 p 4571–4586 refs
(Grant NsG-119-61)

A formula describing the observed photometric properties of the lunar surface is derived theoretically. Functions for both the differential and integral brightness are obtained. The model surface on which the derivation is based consists of a semi-infinite, porous layer of randomly placed obscuring objects suspended in depth in such a way that the interstices separating them are interconnected. A layer of fine, loosely compacted dust is in the category of surfaces described by this model, but volcanic foam is not. The shape of the photometric curve depends on the fractional void volume. Bulk densities of the order of one-tenth that of solid rock are implied for the upper layers of the surface of the moon. Author

N64-22417* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ADVANCED RESEARCH —KEY TO THE FUTURE
Victor Seigel [1964] 43 p

Forward-looking research projects in aeronautics and space exploration are summarized. Topics discussed include low-speed research, supersonic aircraft, aircraft operating problems, manned space flight simulation, electronic computers in aerospace research, launch vehicle and spacecraft dynamics, materials and structures, hypersonic flight, magnetoplasmadynamics, and man-in-space environment. P.V.E.

N64-22474* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LUNAR FLIGHT STUDY SERIES: VOLUME 4. PRELIMINARY INVESTIGATION OF THE ASTRONAUTICS OF EARTH–MOON TRANSITS
Nolan J. Braud 28 Jan. 1963 46 p
(NASA-TM-X-51693; MTP-AERO-63-7) OTS: $4.60 ph

The objective of this report is to present preliminary results of investigations into the problems of earth–moon transits where particular emphasis was placed on the class of trajectories considered for Apollo and support vehicle flights. Flight profiles, velocity budgets, and launch windows are among the areas that are given most attention. One of the primary points is a newly conceived method of establishing a flight mechanical classification of the transits. The classification is made by use of a simplified time invariant coordinate system. The results are empirical and are generated by the integration of the equations of motion by Cowell's method. Impact, as well as flyby transits, is treated, and results are extended to three dimensions. Author

N64-22498 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE ROTATIONAL SPEED OF THE UPPER ATMOSPHERE, DETERMINED FROM CHANGES IN SATELLITE ORBITS
D. G. King-Hele London, Min. of Aviation, Feb. 1964 38 p refs
(RAE-TN-SPACE-59)

The angular velocity of the upper atmosphere is determined by examining the changes in orbital inclination of all suitable satellites. Although the orbital information available is very imperfect, useful values were obtained from 9 satellites, covering the years 1958–1963, heights of 200 to 300 km, and latitudes from 0° to 60°. If the angular velocity of the atmosphere is expressed as Λ times the angular velocity of the earth, the values of Λ obtained all exceed 1, ranging between 1.1 and 1.9, with a mean of 1.46 and rms scatter of 0.28. This corresponds to a mean west-to-east wind speed in midlatitudes of over 100 m/sec. The results thus indicate that the upper atmosphere at 200 to 300 km height rotates faster than the earth. Author

N64-22499 Royal Aircraft Establishment, Farnborough (Gt. Brit.)
THE RAPID COMPUTATION OF EARTH-SATELLITE EPHEMERIDES BY A METHOD USING FOURIER SERIES
R. J. Taylor London, Min. of Aviation, Mar. 1964 29 p refs
(RAE-TN-SPACE-61)

An account is given of an investigation into the feasibility of expressing earth-satellite positions as Fourier series, with a view to computing ephemerides more rapidly than by direct calculation from orbital parameters. The method is found to give sufficiently accurate ephemerides, subject to certain limitations. The main features of the direct, the interpolation, and the Fourier methods of calculating satellite positions are compared. Author

N64-22573* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SIMPLE ABORT SCHEME FOR LUNAR LANDINGS
G. Kimball Miller, Jr. and L. Keith Barker Washington, NASA, Jun. 1964 51 p refs
(NASA-TN-D-2338) OTS: $1.25

A technique was analyzed to abort the lunar mission during the landing phase. The piloted abort technique used a stopwatch and an optical device for measuring the angle between the vehicle thrust nozzle and a visual reference. If the landing is aborted during the first 75% of the landing trajectory, the abort

maneuver consists of applying thrust along the line of sight to the lunar horizon for a time period proportional to the time along the landing trajectory at which abort is initiated. The proportionality constant is the ratio of the thrust-weight ratio used during landing to the thrust-weight ratio used during landing to the thrust-weight ratio used during abort. Aborts initiated later in the landing trajectory require the use of an initial period of thrusting at a steep angle to avoid lunar impact followed by a more horizontal period of thrusting. The abort maneuver can place the ferry vehicle in a safe orbit when the landing is aborted prior to the transition to vertical descent. Increasingly more accurate maintenance of the thrust angle was necessary as the range between landing initiation and abort initiation increased. Thrust-angle errors of $\pm 1°$ were permissible for aborts from the first 75% of the landing trajectory. Later aborts permitted errors of only $\pm 0.5°$ Author

N64-22643 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
SPECTROPHOTOMETRY OF THE LUNAR SURFACE
V. G. Teyfel' 26 Feb. 1963 12 p refs Transl. into ENGLISH from "Spektrofotometriya Poverkhnosti Luny" Leningrad, Akad. Nauk SSSR, 1960 p 3–10
(FTD-TT-63-10/1; AD-299624)

An abstract is presented of a paper concerned with a spectrophotometry study of the lunar surface. The paper is devoted to spectrophotometric and spectrocolorimetric investigation of individual, relatively small sections, and details of the lunar surface. The purpose of the paper is to study the chromatic properties of a great number of lunar objects, situated in various sections of the lunar disk, and the obtainment of spectral curves of a number of lunar-surface sections, as well as a comparison of obtained data with the other optical and morphological properties of these objects. P.V.E.

N64-22680 Polytechnic Inst. of Brooklyn, N.Y.
OPTIMUM LAUNCHING TO HYPERBOLIC ORBIT BY TWO IMPULSES OF UNEQUAL SPECIFIC IMPULSE
Stephen Lubard Jan. 1964 29 p refs
(Grant AF-AFOSR-1-63)
(PIBAL-824; AFOSR-64-0742; AD-600963)

The solution of the optimum launching of a body from a planet into a hyperbolic orbit by two impulses is presented. This problem can be defined in terms of three-dimensionless parameters. It was found convenient to use λ, $\underline{a}$ and $\underline{b}$, where λ is the ratio of the specific impulse of the first impulse to that of the second, and a and b are the ratios of the radius of the planet to the focal distance to the asymptote and to the perigee of the hyperbolic orbit, respectively. The optimum launching solutions will depend on the value of λ as compared to $\underline{b}$, $\overline{\lambda}$ and λ^*, where $\overline{\lambda}$ and λ^* are defined functions of $\underline{a}$ and $\underline{b}$ with $\underline{b} \leq \lambda \leq \lambda^*$. When $0 < \lambda \leq \underline{b}$, the optimum launching orbit starts on the surface of the planet at an angle $\omega_0 = \arccos(\lambda/\underline{b})$, and ends at its apogee, which coincides with the perigee of the final hyperbola. Author

30 SPACE VEHICLES

Includes launch vehicle-spacecraft combinations; missile systems; operating problems; safety devices; and stability and control. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-21495 Army Missile Command, Huntsville, Ala. Physical Sciences Lab.
MATERIALS FOR RE-ENTRY. A SELECTED BIBLIOGRAPHY, 1959–1963
Vernon A. Nieberlein 12 Mar. 1964 74 p refs
(RR-TR-64-1; AD-433656)

This is a selected abstracted bibliography covering the years 1959 through 1963, indexed by subject and author. Materials for reentry, and closely related work on reentry environment, materials requirements, and cooling mechanisms are included. Author

N64-21537* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC ACOUSTICS AS A FACTOR IN SATURN STATIC TESTING
Richard N. Tedrick N.Y., AIAA [1964] 11 p refs Presented at the 1st AIAA Ann. Meeting, Washington, D.C., 29 Jun.–2 Jul. 1964 Previously Published as NASA-TM-X-51438: See N64-14275
(AIAA Paper-64-207) AIAA: $0.50 members, $1.00 nonmembers

The Saturn S-I with its 40 mw of power represents one of the largest steady-state, low-frequency noise sources in the world today. To predict weather conditions for testing and to avoid the danger of damage and harassment to areas surrounding the test sites, accelerated programs have been carried out in the development of large siren systems, full-scale sound suppressors, and atmospheric acoustic propagation studies. In the latter field, a line of acoustic monitoring stations is under construction and extends from the S-IC static test tower through the city of Huntsville, Alabama. A.W.

N64-21776 Boeing Co., Seattle, Wash.
X-20 (DYNA SOAR) NOSE CAP Monthly Technical Progress Report, 15 Oct.–15 Nov. 1963
D. M. While [1963] 12 p Prepared by Ling-Temco-Vought, Inc. For Boeing Co.
(Contract AF 33(657)-7132)
(Rept.-311.25; AD-433936)

Activities of the X-20 nose-cap program are discussed. A bond-failure problem encountered on the verification nose cap has apparently been solved by increasing the surface roughness of the holding pins. Final checkout of the induction heater for reentry heat–vibration testing was made. Instrumentation and heater atmosphere are acceptable for nose-cap tests. P.V.E.

N64-21929 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A ROCKET CARRIER GOES TO THE FIRING RANGE
V. Belikov 1 Feb. 1963 7 p Transl. into ENGLISH from Izvestiya (Moscow), no. 239, 7 Oct. 1962 p 6
(FTD-TT-63-97/1; AD-298211)

A brief narrative description is presented of a flight in a rocket- (antimissile or antiaircraft) launching aircraft during a training mission. P.V.E.

N64-21930 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
PRESENT PROBLEMS OF SOVIET AERONAUTICS
Eli Carafoli 9 May 1963 7 p Transl. into ENGLISH from Rominia Libera (Romania), no. 56, 25 Nov. 1962 p 2
(FTD-T-63-302/1+3+4; AD-409946)

Areas of research that need more investigation, and in which recent developments have made possible the present

state of aircraft and missile development, are discussed. Fields of research discussed include metallurgy, propulsion, electronics, and medicine. P.V.E.

N64-21946 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
HOW MISSILES CAN BE INTERCEPTED AND DESTROYED IN FLIGHT
D. St. Andreescu 9 May 1963 9 p Transl. into ENGLISH from Viata Militara (Rumania), no. 6, Jun. 1962 p 31
(FTD-TT-63-337/1+2+3+4; AD-414712)

Only another missile can be used to combat a missile in flight, because a very fast moving target, flying at great altitude and over long distances, cannot be met and hit by anything but a projectile that is similar, at least with respect to mobility, adaptability, and range. The best height for antimissile encounter would seem to be 130 km. The efficient range of an isolated hit at this height may be as much as 200 meters, depending of course on the "tonnage" of the warhead. To be anticipated at a spot through which it must pass, the target missile must be discovered in time. Time is needed for the technical preparation of the launching from the moment of first warning until "launch readiness." This period can be divided into two parts—the time for technical preparation (mounting of warhead, fueling, programing of trajectory, etc.), and theoretical preparation (computation of the target-missile's trajectory). P.V.E.

N64-21992 Boeing Co., Seattle, Wash.
DYNA-SOAR MANUFACTURING PLAN
L. K. Weeks [1963] 343 p
(Contract AF 33(657)-7132)
(D2-80715; AD-434157)

The plan covers all phases of the manufacturing effort required to produce the glider, transition section, special tooling, and aerospace ground equipment, including the installation of systems, subsystems, and testing. It also includes support to the Systems Integration Laboratory, the Air Force Flight Test Center, and the Atlantic Missile Range. I.v.L.

N64-21995 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report, 1–31 Jul. 1963
10 Jul. 1963 74 p Prepared for Boeing Co. by Sundstrand Corp.
(DSR-21; AD-433924)

Work status in the following areas is reported: (1) subsystem status—prime mover, gearbox and lubrication system, combustor, hydraulic pump, regenerator and preheater, control valves, electronic controller, accessories, and system testing; (2) system analysis; (3) reliability—critical design review action items, vendor coordination, electronic control manufacturing and inspection support, specification and print review, engineering change request, and development test monitoring; and (4) unit build and test status. R.T.K.

N64-21996 Boeing Co., Seattle, Wash.
X-20 (DYNA-SOAR) ACCESSORY POWER UNIT Development Status Report, 1 Nov.–31 Dec. 1962
10 Jan. 1963 104 p Prepared for Boeing Co. by Sundstrand Corp.
(DSR-14; DSR-15; AD-433927)

The status of the following is presented: (1) components, including the prime mover; the gear box, lubrication system, and cold plate; the combustor; the hydraulic pump; the regenerator; control valves; the electronic controller system; the tach generator; and the magnetic pickup; (2) the integration of the new turbine simulation into the computer simulation; (3) thermodynamic system analysis; (4) components and systems reliability; and (5) hardware status and tests of various pieces of hardware. I.v.L.

N64-22445* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DYNAMICS OF A ROTATING SPACE STATION
Walter P. Krause Feb. 1964 51 p refs
(NASA-TM-X-51695; R-COMP-RS-64-1) OTS: $5.60 ph

The dynamics of a cylindrical space station rotating around its major axis once every 10 seconds are evaluated numerically. The long cylinder provides the large distance between the axis of rotation and the crew compartment needed to generate comfortable artificial gravity. But the rotating cylinder is known to have little dynamic stability around its longitudinal axis. Nevertheless, the stability characteristics of this configuration are found to be acceptable provided there is as little as 0.2% asymmetry between the major and intermediate moments of inertia. Detailed investigations were performed on an analog computer. These show the effect of path and timing on the magnitude of the disturbance caused by a mass relocation. Also analyzed in some detail are ways to minimize roll, either by corrective motion of the astronauts or by a simple control system, that use the gyroscopic torque generated by rotating the body-fixed axis of a flywheel. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes boosters; clustered rockets; and multistage rockets. *For propulsion engines see*: 27 Propulsion. *For manned space capsules, satellites, and sounding rockets and space probes see*: 32 Space Vehicles (Spacecraft). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-22008 Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
THE THOR HISTORY
W. H. Hooper May 1963 96 p
(SM-41860)

This history is intended to briefly acquaint the reader with Thor and its systems. The report briefly describes the development of Thor, summarizes and chronicles Thor missile and booster launchings, provides illustrations and descriptions of the vehicle systems, relates their genealogy, explains some of the performance capabilities of the Thor and Thor-based vehicles used, and focuses attention to the exploration of space. Author

N64-22260 Boeing Co., Seattle, Wash.
LAUNCH CONTROL EQUIPMENT BREADBOARD DEVELOPMENT PROGRAM — MODEL X-20
G. E. Shawver [1964] 92 p
(Contract AF 33(657)-7132)
(D2-81073; AD-433990)

This document has been compiled to identify engineering models (breadboard) of launch-control equipment and design configuration for the X-20. Components are identified by

illustrations, by functional descriptions, and by breadboard photographs. These areas are considered: (1) protective monitor and control rack; (2) glider test-conductor console; (3) glider launch-conductor console; (4) test-control simulator rack; (5) distribution rack; (6) the LH_2 servicing control rack; (7) the O_2 servicing control rack; (8) the LN_2 servicing control rack; (9) glider launch servicing console; and (10) test-signal simulators. N.E.A.

N64-22479* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POST-SATURN LAUNCH VEHICLE STUDY (PART II) Condensed Summary Report
N. G. Huber 10 Apr. 1964 19 p
(NASA-TM-X-53010) OTS: $1.60 ph

The purpose of this report is to summarize the results of studies to define vehicle concepts for a large launch vehicle beyond Saturn V. The report outlines the scope and objectives of the study, presents conclusions based on the resulting data, and gives recommendations for future work. A wide range of concepts was investigated and was divided into current technology, advanced state-of-the-art, and very advanced technology. The recommended future work includes follow-on studies to perform a more detailed design of Class II, update Class I concepts, perform a concentrated mission analysis, further define required technology advances, and make a comparison of all promising Class III concepts. The role of the present M-1 engine and large solids should be determined, and the current technology program should be oriented to provide a sound base for further post-Saturn investigations. Author

N64-22480* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESTRUCT TESTS ON SCALE MODEL SATURN I BOOSTER
J. B. Gayle and C. H. Blakewood 3 Feb. 1964 46 p refs
(NASA-TM-X-53007) OTS: $4.60 ph

Multiple tank clusters representing Saturn I boosters and containing 3,500 lb of LOX/RP-1 were destroyed by using internal and external destruct systems. The explosive yields for both systems were low and, therefore, tended to refute the suggestion that the cluster configuration of this vehicle necessarily would result in increased yields by comparison with vehicles having dual tanks in tandem configuration. Comparisons of results for the two destruct systems indicated somewhat lower yields and less fragmentation for the external destruct system. Author

32 SPACE VEHICLES (SPACECRAFT)

Includes manned space capsules; satellites; and sounding rockets and space probes. *For boosters and launch vehicles see*: 31 Space Vehicles (Launch Vehicles). *For launch vehicle-spacecraft combinations see*: 30 Space Vehicles. *For related information see*: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N64-21499 Aeronutronic, Newport Beach, Calif.
SPIN-UP STUDY FOR THE RANGER LANDING SYSTEM, VOLUME III Final Report
J. F. Mc Carty 30 Oct. 1963 107 p refs Prepared for Northrop Space Labs.
(U-2252)

The object of this part of the study is to review the existing design and to investigate alternative designs for the Ranger spin-up subsystem. The overall task of the spin-up subsystem is to impart 30 radians/second of rotational velocity (about the roll axis) to the landing system. It is important that the space orientation of the primary role axis remain as fixed as possible. Error phenomena for three systems are considered in the rigid-body analysis, viz, free-spin system, full restraint system, and partial restraint system. A comparative evaluation of five design concepts were made on the basis of Ranger requirements. The total effect of all the proposed modifications is to eliminate some 22 pieces of hardware on the spin motor and throat plug alone, while increasing circuit checkout capability, installation time, and safety to a level consistent with the rest of the spacecraft. The final design is discussed in detail. D.S.G.

N64-21511 Philco Corp., Palo Alto, Calif. Western Development Labs.
MORL STUDY PROGRAM: DATA MANAGEMENT AND COMMUNICATIONS SUBSYSTEM. COMPILATION OF PRELIMINARY DATA ON AIRBORNE COMMUNICATIONS AND GROUND CONTROL, CENTRAL CONTROL AND COMPUTING UNIT Technical Proposal
[Aug. 1963] 25 p refs
(WDL-TP-1209)

Data contained herein were tailored to the NASA Manned Orbiting Research Laboratory (MORL) and are presented in four parts, as follows: (1) Introduction and Technical Summary; (2) Airborne Communications; (3) MORL Tracking Communications and Ground Control; and (4) Central Control and Computing Unit. A.W.

N64-21677 General Electric Co., King of Prussia, Pa. Space Sciences Lab.
A SELECTED BIBLIOGRAPHY ON MANNED ORBITAL SPACE STATIONS [1958–JUNE 1963]
Margaret W. Sykes Aug. 1963 46 p refs
(R63SD65)

This bibliography contains 135 references to publications on manned orbital space stations and their components, including structural materials, power supplies, and life-support systems. The references are arranged alphabetically by author, and abstracts have been supplied when available. N.E.A.

N64-21730 Gt. Brit. Dept. of Scientific and Industrial Research, Slough Radio Research Station
WORLD DATA CENTRE C: ROCKETS AND SATELLITES. SECOND TWO-YEARLY CATALOGUE OF DATA, REPORTS AND REPRINTS RECEIVED BETWEEN JANUARY 1962–DECEMBER 1963
Mar. 1964 74 p refs

This catalog is divided into two parts. The first part includes rocket-flight information summaries and satellite data—positional observations, orbital data, and radio observations. The second part contains a bibliography of reports and reprints on the following subjects: space research; satellites and probes; orbits and flight paths; tracking; data recovery; instrumentation; applications of satellites; interplanetary probes; gravitational fields; magnetic fields; radiation; atmosphere; ionosphere; radio-wave propagation; and meteors, meteorites, interplanetary dust, and tektites. R.T.K.

N64-21731 Gt. Brit. Dept. of Scientific and Industrial Research, Slough Radio Research Station
WORLD DATA CENTRE C: ROCKETS AND SATELLITES. SECOND TWO-YEARLY CATALOGUE OF DATA, REPORTS AND REPRINTS RECEIVED BETWEEN JANUARY 1962–DECEMBER 1963

Mar. 1964 74 p refs

A catalog is presented that gives rocketry and satellite data. The rocketry data include flight information and research data; the satellite data include positional observations, orbital information, radio observations, and research data. C.L.W.

N64-21818 Naval Research Lab., Washington, D.C.
THE NRL SOLAR MONITORING SATELLITE PROGRAM
R. W. Kreplin *In its* Report of NRL Progress May 1964 p 1–10 (See N64-21817 15-01) OTS: $1.25

The Naval Research Laboratory's first solar observatory was placed in orbit in June 1960 to obtain a reliable time history of short ultraviolet and X-rays from the sun. The fourth since the long-term solar monitoring observatories became available was placed in orbit in January 1964. The sun does not normally emit any X-rays below 8 A whose flux exceeds 0.6×10^{-3} erg-cm^{-2}/sec for a 2-million degree Planckian distribution. Whenever the X-ray emissions in the region below 8 A exceed the flux just cited, there are one or more distinct active events to be seen on the solar disk. Shortwave fadeouts and other ionospheric effects are produced when the flux of X-rays in the wavelength range 0 to 8 A exceeds 2×10^{-3} erg-cm^{-2}/sec. Rapid changes in solar Lyman-alpha emission are not geophysically significant. Large variations in the 8 to 20 A band are observed during periods when ground-based indicators of solar activity show little change. Author

N64-21821 Aeronutronic, Newport Beach, Calif.
DISPERSION PERFORMANCE STUDY FOR THE RANGER LANDING SYSTEM, VOLUME I OF III Final Report
J. F. Mc Carty 30 Oct. 1963 95 p refs (Prepared for Northrop Corp.)
(U-2252)

The basic operating principles and capabilities of the landing system are summarized. Included is a functional description plus control aspects relating to the system. Also, a dispersion model is presented for the purpose of predicting the system's flight performance. The summary is divided into the following areas: (1) system description—mission requirements, design philosophy, system configuration, and operational sequence; (2) trajectory control—retrovelocity and fuzing range, retroignition control, and retroweight allocation; (3) dispersions—error formulas, probability model, and probability error equations; and (4) system performance—the nominal system, predicted performance, and effects of nonstandard conditions. P.V.E.

N64-22019* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPLORER VIII SATELLITE MEASUREMENTS IN THE UPPER IONOSPHERE
R. E. Bourdeau and J. L. Donley Washington, NASA, Jun. 1964 22 p refs
(NASA-TN-D-2150) OTS: $.75

This is an extensive report on upper ionospheric ion composition, electron temperature, and spacecraft-plasma interaction, all measured by Explorer VIII. Results from an ion-retarding-potential experiment show that the upper ionospheric composition responds to the neutral gas temperature. Explanations are suggested for differences between the Explorer VIII T_e observations and other ground-based and spaceflight measurements of upper ionospheric parameters. The measured satellite-plasma interaction is consistent with theory, lending confidence to the geophysical results described. The observed average satellite potential varied from a few tenths of a volt negative at night, to zero when the measured daytime charged particle density was 10^4 cm^{-3} and thence to a few tenths of a volt positive for daytime densities of 10^3 cm^{-3}. Superimposed on the average potential were experimentally observed potential gradients across the satellite skin—an effect produced by the movement of a conducting body through a magnetic field. The measured orientation sensitivity of three types of current flowing between the satellite and the ionosphere is described. Author

N64-22020* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ECHO I INFLATION SYSTEM
Dewey L. Clemmons, Jr. Washington, NASA, Jun. 1964 56 p refs
(NASA-TN-D-2194) OTS: $1.50

A study was made to determine the feasibility and selection of a subliming compound to be used as an inflation system for the Echo I satellite. Primary considerations were given to the compatibility of such a system with payload weight limitations, storage in satellite, internal pressure requirements, and the minimum length of time that the inflation need be sustained. Calculations were made to determine the temperature variations of the satellite while in sunlight and shadow, the deforming loads present in the environment of space, the effects of micrometeoroids with regard to holes punctured in the satellite, the method of selecting the proper subliming compound, and the pressure time history and mass flow rate of the inflation vapors. Subliming organic compounds lend themselves very well to the initial inflation of large, thin wall, spherical configurations in orbit above the earth's atmosphere, and pressure sustenance can be achieved for periods of the order of a few weeks. A comparison between the predicted performance of the inflation system and that inferred by experimental scattering of microwave signals by the satellite is discussed; the sphericity of the satellite began to degrade after a period of 6 to 12 days after launch. Author

N64-22153 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE STUDY OF THE EARTH'S ATMOSPHERE AND OF COSMIC SPACE WITH THE HELP OF SOVIET COSMIC ROCKETS AND ARTIFICIAL SATELLITES
Edmond Nicolau 12 Sep. 1962 16 p refs Transl. into ENGLISH from Telecomunicatii, no. 2, 1960 p 20–25
(FTD-TT-62-464/1+2+3+4; AD-286619)

Radio-engineering methods employed in the exploration of the ionosphere are described, and the results obtained from the data collected by Soviet space rockets and artificial satellites are discussed. Results are presented for work on the following: (1) measurements of cosmic radiation; (2) the origin of the polar auroras; (3) the chemical composition of the upper atmosphere, using a mass spectrometer; (4) the terrestrial magnetic field; (5) the magnetic field in the immediate vicinity of the moon; and (6) the detection of micrometeorites, which play an important part in the ionization of the atmosphere. J.L.D.

N64-22296 Aerospace Corp., El Segundo, Calif. Electronics Div.
GUIDANCE FOR EXTREME MANEUVER CAPABILITY IN ATMOSPHERIC ENTRY AT SUPERCIRCULAR VELOCITY
J. E. Lesinski 4 May 1964 129 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-85; TDR-269(4540-70)-1; AD-601254)

Results of an investigation into a general technique for the guidance of a manned lifting vehicle during an arbitrary reentry mission involving supercircular entry speeds are presented. Preliminary design results are presented for an automatic system to provide flight path control to achieve safe reentry as well as an energy management function to allow landing at a preselected site. The guidance concept is directed at a utilization of the large inherent in-atmospheric maneuver capability of the lifting glider. System performance is demonstrated through a three-degree-of-freedom analog computer reentry simulation. Author

N64-22307 General Dynamics/Pomona, Calif.
AIR-LAUNCHED ROCKETSONDE STUDY Final Report
R. F. Wenzel Jan. 1964 431 p refs
(Contract AF 19(628)-3265)
(AFCRL-64-59; AD-601216)

A study was conducted on the feasibility of incorporating an air-launched rocketsonde into the existing WB-47 AN/AMQ-19 meteorological system. An economically feasible system was established, one capable of carrying pressure, temperature, and humidity sensors to 150,000 ft. Growth capability in the design permits attainment of 400,000 ft altitudes with the same Judi or Loki II rocket motor. Author

N64-22338 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
MAIN GOALS OF THE HISTORICAL FLIGHT
B. Semenov 8 Mar. 1963 6 p Transl. into ENGLISH from Sov. Rossiya (USSR), no. 192, 15 Aug. 1962 p 2
(FTD-TT-63-24/1; AD-401727)

The main goals of Nikolayev and Popovich in their flight were to aid in the creation of a perfected and dependable system of spacecraft control. Methods of determining the rotation of the spacecraft around its center of gravity and then to stabilize it, the use of rocket engines for changing the speed or direction of the flight in space, and automatic and manual control are discussed. I.v.L.

N64-22383 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
TOWARD NEW SUCCESSES IN STUDY OF OUTER SPACE
G. S. Titov 6 Sep. 1962 21 p Transl. into ENGLISH from Vestnik Akad. Nauk SSSR (Moscow), v. 32, no. 7, 1962 p 10–18
(FTD-TT-62-1189/1; AD-286573)

The details of Titov's space flight on 6–7 August 1961, as well as the construction of Vostok-2 are discussed. The problems associated with manned flight into outer space and with the general training of cosmonauts are outlined. R.T.K.

N64-22439* Massachusetts Inst. of Tech., Cambridge
MARINER 2 MICROWAVE RADIOMETER EXPERIMENT AND RESULTS
F. T. Barath (JPL), A. H. Barrett, J. Copeland (Ewen Knight Corp.), D. E. Jones (JPL and Brigham Young U.), and A. E. Lilley (Harvard Coll. Observatory) Repr. from Astron. J., 69, no. 1, Feb. 1964 p 49–58 refs
(Grant NsG-250-62)

A microwave radiometer experiment aboard Mariner 2 successfully measured emission from Venus at wavelengths of 13.5 and 19 mm on three scans of the planetary disk. The areal resolution was high, the half-power beamwidths of the antennas being approximately 1/6 of the angle subtended by the Venusian disk. The purpose of this paper is to do the following: (1) review the background and objectives of the experiment and the design constraints imposed by spacecraft technology; (2) provide an engineering description of the experiment; (3) describe the in-flight performance of the equipment and its effect on the planetary results; (4) present the microwave data acquired; and (5) present an analysis and interpretation of the data and the conclusions drawn therefrom. The results provide quantitative data for microwave limb darkening of Venus and thus give strong support to that class of model atmospheres that have high temperatures originating at, or near, the surface of the plant. Author

N64-22461* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
RANGER 1964
[1964] 37 p ref
(NASA-CR-56289) OTS: $3.60 ph

The mission of the Block III Ranger flights is to obtain television pictures of the lunar surface. The pictures are expected to be at least an order of magnitude better in resolution than any earth-based photography. The Ranger spacecraft, mounted atop the Atlas-Agena combination launch vehicle, carries a multiple TV camera subsystem. A series of about 3,000 video pictures, commencing approximately 10 minutes before lunar impact, is expected to be obtained by each mission. Included is a discussion of the moon, launching problems, spacecraft description, space-flight operations, and mission description. P.V.E.

N64-22468* Princeton U. Observatory, N.J.
BALLOON PROJECT Progress Report, Apr. 1963–Apr. 1964
Martin Schwarzschild and Robert E. Danielson [1964] 12 p (Grants NsG-69-60; NSF-G-5464; NSF-G-9755; NSF-G-14905; Contract Nonr-1858(03))
(NASA-CR-56309) OTS: $1.60 ph

Improvements in the balloon system and in its operations are described for the flights of Stratoscope II. Also discussed are: (1) optical work on the primary mirror of Stratoscope II; (2) repairs and improvements of the telescope; (3) second flight of Stratoscope II and the scientific results; (4) preparation for the first photographic flight; and (5) integrating television. N.E.A.

N64-22622 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
THE FIRST ASTRONAUTS AND THE FIRST SCOUTS OF OUTER SPACE
M. A. Gerd and N. N. Gurovskiy 23 May 1963 261 p Transl. into ENGLISH of the Book "Pervyye Kosmonavty i Pervyye Razvedchiki Kosmosa" Moscow, Izd. Akad. Nauk SSSR, 1962 p 1–198
(FTD-TT-1300/1+2; AD-413602)

A popular account of the selection and training of dogs and men for Soviet space flights is presented. The provisions that were made for the normal functioning of the astronauts during spaceflight and for telemetering physiological and behavioral data are reviewed. Some of the scientific data derived from the flights of Yu. A. Gagarin and G. S. Titov are included. M.P.G.

N64-22647 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
A BRILLIANT ASTRONAUTICAL ACHIEVEMENT, VOSTOK-3 AND VOSTOK-4 IN SIMULTANEOUS FLIGHT

Florin Zaganescu 9 May 1963 12 p Transl. into ENGLISH from Stiinta Si Teknica (Bucharest), no. 8, Aug. 1962 p 24–25, 45
(FTD-TT-63-306/1+2+3+4; AD-409944)

A description of activities surrounding the double flight of spaceships Vostok III and Vostok IV is presented, and the technical requirements of the flight are discussed. P.V.E.

33 STRESSES AND LOADS

Includes fatigue; vibration; flutter; and structural tests. *For thermal stress see*: 13 Heat Transfer and Thermodynamics. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 34 Structural Design.

N64-21521 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Inst. für Luftfahrzeugfuhrung
TESTING METHODS, OBSERVATIONS, AND TEST READINGS OF VIBRATION MEASUREMENTS IN THE Do 27 [MESSMETHODE, ERFAHRUNGEN UND MESSERGEBNISSE UBER VIBRATIONSMESSUNGEN IN DER Do 27]
E. Lubeck 25 Jul. 1963 58 p refs In GERMAN
(DFL-230) DFL: DM 17

Various methods for measuring vibration in the Do 27 were investigated. These methods include the following: (1) measurement of the total vibrational level; (2) measurement of the spectral components; (3) the use of frequency distribution; and (4) the use of a piezoelectric accelerometer. It is indicated that a piezoelectric accelerometer provides the best method for measuring vibrational level of aircraft and flying bodies because of its sturdiness, compactness, and its large amplitude characteristic. I.v.L.

N64-21528 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (W. Germany)
INTRODUCTION OF SHEARING FORCES IN CYLINDRICAL OR SECTIONALLY VARIABLE CONICAL THIN SHELLS [QUERKRAFTEINLEITUNG IN ZYLINDRISCHE ODER ABSCHNITTSWEISE KONISCH VERANDERLICHE DUNNE SCHALEN]
G. Czerwenka (Focke-Wulf GmbH) Mar. 1964 110 p refs In GERMAN; ENGLISH summary
(DVL-274) DVLR: DM 30

This report deals with theoretical investigations, confirmed by appropriate experiments, on the principle relations concerning the problem of introducing shearing forces in conical and sectionally variable shells. The experiments were aimed at determining the distribution of strain in sheet metals and frames as a function of frame distance, frame rigidity, thickness of the sheet metal, and gradient of the individual shell areas. They also included determination of the decay rate of stress peaks produced by the introduction of shearing forces. Author

N64-21697 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (W. Germany) Institut für Flugzeugbau
ELEMENTAL COMPUTATION OF SHELLS AND SOLID WALL SYSTEMS, PART I [ELEMENTARE BERECHNUNG VON SHALEN UND VOLLWANDSYSTEMEN, TEIL I]
E. Schapitz and G. Levin Düsseldorf, Verlag des Vereins Deutscher Ingenieure, 1963 32 p refs Luftfahrt-Forschungsberichte des Bundesministers für Verkehr, Heft 21 In GERMAN

The calculations presented are mainly for the fuselage, wings, and tail planes. Emphasis is placed on torsion-free shear bending and on the determination of the center of shear. I.v.L.

N64-21707 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Burnswick (W. Germany) Inst. für Flugzeugbau
THE OSCILLATING BEHAVIOR OF TRANSVERSELY LOADED CIRCULAR CYLINDER SHELLS [DAS SCHWINGUNGSVERHALTEN BIEGEBELASTETER KREISZYLINDERSCHALEN]
P. Seggelke 17 Dec. 1963 45 p refs In GERMAN
(DFL-231) DFL: DM 11.50

Based on the linearized Donnell Theory, the effect of a variable axial stress of cos y/a across the circumference, on the characteristic frequency and natural vibration of thin-walled, isotropic circular cylinders was investigated. In the calculation, reinforced ends ($w = 0$, $w'' = 0$, $N_x = 0$, $V = 0$) were assumed. Also, the bending stress of circular cylinders is discussed, and the types of characteristic frequency and natural vibration are described. I.v.L.

N64-21726 Royal Inst. of Tech., Stockholm (Sweden)
ON THE MECHANISM OF BRITTLE FRACTURE PROPAGATION. BRANCHING, FRACTURE SURFACE APPEARANCE, AND INFLUENCE OF STRESSWAVES
A. Janne Carlsson 1963 42 p refs *Its* Trans. no. 205 (Mech. Eng. 10)

Crack solutions of the theory of elasticity are used to obtain a crack model that takes into account the effect of shear stresses in the plane of the crack and plastic effects at the head of the crack. An attempt is made to formulate a more realistic fracture criterion for semibrittle materials. The crack model is found to be of significant importance in the explanation of branching, fracture appearance, and the effect of stress waves on fracture propagation. Author

N64-21805 Aberdeen Proving Ground, Md. Ballistic Research Labs.
RESPONSE OF SUBMERGED SPHERICAL SHELLS TO INTERNAL BLAST LOADING
W. E. Baker (Aircraft Armaments, Inc.), J. W. Hanna and J. D. Patterson Dec. 1963 38 p refs
(BRL-1231; AD-434702)

This report presents the results of experiments on the response of thin spherical shells submerged in water to blast from internal explosive charges, and compares the results with theory. In addition, results of measurements of the underwater shock transmitted from the shells into the surrounding water are reported, and these shock intensities are compared to direct underwater shocks. Author

N64-21808 Aberdeen Proving Ground, Md. Ballistic Research Labs.
THE PLASTIC RESPONSE TO INTERNAL BLAST LOADING OF MODELS OF OUTER CONTAINMENT STRUCTURES FOR NUCLEAR REACTORS
John W. Hanna and William O. Ewing, Jr. Jan. 1964 32 p refs
(BRL-MR-1530; AD-433618)

Presented are results of an experimental investigation of the plastic response of two geometrically scaled models of nuclear reactor outer containment vessels to internal blast loading. Tests were performed to study the ability of the containment shells to maintain integrity when subjected to large amounts of explosively released energy when unsupported (suspended in air), when half-buried in the ground, and when half-imbedded in concrete. The results show that the vessels

tested will withstand a relatively large amount of explosively released energy, as compared to the "maximum credible incident" expected, provided that the welds are adequate and that access or other openings are properly reinforced. Author

N64-21845 Advisory Group for Aeronautical Research and Development, Paris (France)
SOME PANEL AEROELASTIC INSTABILITIES
D. J. Johns (RAE) Sep. 1963 58 p refs
(AGARD-474)

Several theoretical and experimental investigations are presented and discussed that indicate the possible range of static and dynamic aeroelastic instabilities of thin panels and membranes. Subsonic instabilities include panel and membrane flutter and panel "divergence." The need for a suitable three-dimensional theory is shown. Supersonic flutter of flat panels and cylindrical panels shows considerable disparity between theory and experiment particularly in the Mach number range below $\sqrt{2}$. More definite experiments and analyses that allow for viscous flow effects are required. Author

N64-21951 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
CONTRIBUTIONS TO THE STUDY OF MEMBRANE DEFORMATIONS OF SHELLS
Mircea Soare 10 Sep. 1963 26 p refs Transl. into ENGLISH from Studii Si Cercetari De Mecanica Aplicata (Romanian), v. 13, no. 5, 1962 p 1279–1299
(FTD-TT-63-598/1+2+3+4; AD-422245)

The membrane deformations for shallow shells having a positive gaussian curvature are determined, and the results are applied to the elliptical and revolution paraboloid. Generalizations are made on the graphic-analytical method of Mohr used in the calculation of the sagitta of a beam subjected to bending. The applicability limits of membrane theory are discussed, and the real variation of the deformations obtained by applying the bending theory is specified. Finally, the membrane stresses in a statically indeterminate case of support are determined. M.P.G.

N64-21986 Royal Inst. of Tech., Stockholm (Sweden)
EXERCISES IN CREEP MECHANICS
F. K. G. Odqvist 1964 11 p *Its* Publikation no. 144

This paper contains some problems and answers in the mechanics of metallic creep. The calculations leading to the answers given are based on the so-called total deformation theory, which is particularly suited to describing material behavior in the secondary stage of creep, taking into account corrections of total primary creep. Included is a table of creep constants of structural metals. N.E.A.

N64-21987 Royal Inst. of Tech., Stockholm (Sweden)
BENDING AND AXIAL STRESS FATIGUE STRENGTH OF AlMgSi ALLOY AS PARENT MATERIAL AND IN WELDED CONDITION
Lars Oberg 1964 72 p refs *Its* Publikation no. 145

For bending stress tests, in CIDA No. 8 and 34, the influence of sheet thickness was determined for parent material (CIDA No. 8) and for butt welded material (CIDA No. 34). These two series (8-mm sheet material) were compared with CIDA No. 3 and 32, respectively. Testing axial stress, in CIDA No. 37, 38, 130, and 131 the SN curves were determined for two kinds of fillet welds and for R = 0 and R = −1. Each series contains nine or more fatigue tests at three different stress levels in order to obtain the SN curve in the life range $N = 10^4 - 10^6$. The fatigue tests were complemented with tensile tests on both parent and welded material. The influence of various parameters was studied in a number of shorter test series planned to permit an efficient comparison with the four series above. Author

N64-22026 National Aeronautics and Space Administration, Washington, D.C.
POST-BUCKLING BEHAVIOR OF CYLINDRICAL SHELLS. PART III. TORSION
A. V. Pogorelov Jun. 1964 99 p refs Transl. into ENGLISH of the paper "Tsilindricheskiye Obolochki Pri Zakriticheskikh Deformatsiyakh. III. Krucheniye" Khar'kov. Izd. Khar'kovsk. Univ., 1962
(NASA-TT-F-196) OTS: $2.25

The method of investigation is based on three simple and natural propositions: (1) The transcritical elastic deformation of a shell is primarily a state of geometric bending. (2) The structural periodicity of the shape of the buckled shell is predetermined by the nature of the periodicity of the deflections at the moment of loss of stability. (3) The transition to the transcritical state of deformation of the shell is linked with the appearance of clearly expressed ridges in its surface. Author

N64-22046 Minnesota U., Minneapolis Inst. of Tech.
ATTENUATION OF PLANE WAVES IN A SEMI-INFINITE COMPOSITE BAR
R. Plunkett and C. H. Wu 24 Feb. 1964 29 p refs
(Contract Nobs-86783)
(AD-431282)

Flexural waves in plates (or beams) may be rapidly attenuated by stiff septa bounded to the plate by viscoelastic, dissipative layers. The attenuation of traveling compressive waves as a function of frequency may be used to find the solution for arbitrary time variation of the load by impedance and by Fourier transform techniques. The steady-state solution of a semiinfinite column loaded at one end by a sinusoidal force is discussed in detail. The specific mathematical model considered consists of a main strip and two identical septa of the same material. The two septum are serrated to reduce their effective sonic velocity and are symmetrically bonded to the two faces of the main strip by the same kind of viscoelastic material. Particular problems considered are the influence of end conditions and complex shear modulus on the attenuation, and the mode shapes at maximum attenuation. P.V.E.

N64-22047 Rensselaer Polytechnic Inst., Troy, N.Y.
ANALYSIS OF THE DYNAMICS OF ELASTIC SYSTEMS Final Report, 1 Nov. 1962–31 Dec. 1963
George H. Handelman and William E. Boyce 24 Jan. 1964 5 p refs
(Grant AF-AFOSR-182-63A)
(AFOSR-64-0144; AD-434417)

Two major areas of investigation were considered: (1) wave propagation in elastic materials; and (2) statistical problems in elastodynamics. A study of the effects of slight surface irregularities on wave propagation in an elastic half space was completed. Questions on the behavior of zeros of Bessel functions appropriate to the study of diffraction problems have been considered. Work has progressed on the statistical analysis of the frequencies of free vibrations in certain simple elastic problems. N.E.A.

N64-22048 Polytechnic Inst. of Brooklyn, N.Y.
PARAMETRIC EXPANSIONS FOR OVAL REINFORCING RINGS
William P. Vafakos and Neil Nissel Mar. 1964 37 p refs
(Contract Nonr-839(14))
(PIBAL-684; AD-434738)

Formulas are derived for the stresses and displacements in a deep oval ring that is subjected to arbitrary distributed radial and circumferential loads. The results, which are sufficiently accurate for design purposes, are obtained as power series expansions in a parameter that fixes the major-to-minor axis ratio of the oval. For a uniform radial load, graphs are presented comparing the results for the assumed oval cross section with the corresponding results of an available closed form solution for a different, but similar, oval section. The small differences in the results can be traced to similar differences in the assumed overall geometries and do not appear to be affected by relatively large differences in the local curvatures. Author

N64-22082 Royal Inst. of Tech., Stockholm (Sweden) Division of Strength of Materials
TOTAL STRAIN THEORY OF CREEP INCLUDING RECOVERY
Gert Hedner 1963 35 p refs *Its* Transactions no. 214, Mech. Eng. 12 Elanders Boktryckeri Aktiebolag, Göteborg: 4.50 Kronor

The purpose of this paper is to take into account the phenomenon of creep recovery within the limits of the total strain theory of creep due to Odqvist (1952), as well as to examine how the predictions of some other experimentally observed phenomena are influenced by the recovery term. Author

N64-22086 Materials Research Lab., Inc., Richton Park, Ill.
THE USE OF STRAIN SOFTENING TO IMPROVE THE PROPERTIES OF REFRACTORY METALS Quarterly Progress Report No. 1, Dec. 1, 1963–Feb. 29, 1964
E. J. Ripling and S. Zager [1964] 8 p ref
(Contract NOw-64-0247-c)
(AD-434207)

An understanding of the mechanics of the MRL-flexing machine, and improvement of the reliability and repeatability of experiments are discussed. The roller-flexer was stiffened; accuracy of the gap setting was improved; tensile loads during flexing were recorded as a function of travel; surface strains, as measured by curvature, and thickness strains were recorded after each pass; and temperature control during specimen testing was improved. Molybdenum–0.5 Ti Alloy (.055 inch thick) was flexed at room temperature. Tensile loads were equalized insofar as possible for both directions of travel. Author

N64-22092* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EVIDENCE FOR REVERSION DURING CYCLIC LOADING OF AN ALUMINUM ALLOY.
A. J. McEvily, Jr., J. B. Clark (Ford Motor Co.), E. C. Utley (Lockheed Aircraft Corp.), and W. H. Herrnstein III Repr. from Trans. of the Met. Soc. of AIME, v. 227, Oct. 1963 p 1093–1097 refs

Specimens of 2024-T4 aluminum alloy were aged for 16 hr at 150° C after cycling for 10% of the life at 25,000 psi. These specimens were then tested to failure and exhibited a marked increase in fatigue life. It is proposed that during the early stages of fatigue in this alloy, dislocations cut through the coherent precipitate and bring about the reversion of the precipitate. Subsequent aging at 150° C induces reprecipitation in the precipitate-free zones so that the weakened regions are strengthened and the fatigue life is extended. Author

N64-22118 Royal Inst. of Tech., Stockholm (Sweden)
METHOD FOR CONTINUOUS MEASUREMENT OF INSTANTANEOUS CRACK PROPAGATION VELOCITIES
A. Janne Carlsson 1963 30 p refs *Its* Transactions no. 207, Mech. Eng. 11 Elanders Boktryckeri Aktiebolag, Göteborg: 3.50 Kronor

Several methods are used to measure velocities of crack propagation in structures. The most straightforward of these are the ones where the impedance over the crack is determined, giving a measure of the length of the crack. Measurements of this type are preferably performed using a high-frequency current. The measured impedance is then high, and the high frequency allows measurement of high crack propagation velocities, even equal to the velocity of sound. In the high-frequency case the impedance can be theoretically deduced when the geometry consists of a straight crack traversing a plate. The deductions are given. Author

N64-22144 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
STRUCTURAL STRENGTH OF GAS TURBINE PLATES UNDER UNSTEADY OPERATIVE CONDITIONS
A. P. Dinerman and L. B. Getsov 29 Jan. 1963 15 p refs Transl. into ENGLISH from Teploenerg. (USSR), no. 5, 1962 p 38–43
(FTD-TT-62-1798/1+2+4; AD-298214)

Efficiency problems of turbine plates with different sized peripheral concentrators were scrutinized under conditions of repeated rapid starting. The nature and causes of plate failure were analyzed, and the impossibility of determining the number of startups leading to failure was demonstrated by means of calculations from durability exhaustion formulas and from Coffin's formula. Author

N64-22202 Institute for Defense Analyses, Washington, D.C. Research and Engineering Support Div.
LARGE AMPLITUDE VIBRATION AND RESPONSE OF CURVED PANELS Research Paper D-13
Benjamin E. Cummings Mar. 1963 37 p refs
(ARPA-SD-50)
(IDA/HQ-63-1346; AD-433885)

The dynamic nonlinear shallow-shell equations are examined in the special case of a cylindrical shell segment. Different developments are given for System A, where the stress boundary conditions are satisfied exactly and compatibility is satisfied on the average, and for System B, where compatibility is satisfied exactly and the stress boundary conditions are satisfied on the average. Perturbation and exact integral expressions are found for the frequencies of vibration. The response to delta-function, step-function, and harmonic-function loading is examined. Dynamic buckling is predicted by shock response method. Author

N64-22208 General Electric Co., Cincinnati, Ohio Nuclear Materials and Propulsion Operation
HIGH-TEMPERATURE MATERIALS PROGRAM Progress Report No. 35, Part A
28 May 1964 57 p refs
(Contract AT(40-1)-2847)
(GEMP-35A) OTS: $1.50

The current program status includes the following: (1) The stress-rupture and creep properties of rhenium and tungsten were determined at 2,200° and 2,600° C in hydrogen. (2) A more accurate measurement of creep, using paired filar micrometer telescopes, was obtained for arc-cast molybdenum at 2,200° C. (3) It was demonstrated that strain measurements and the creep rate for arc-cast molybdenum at 2,200° C were not affected by several temperature cycles. (4) Tests evaluating the effect of grain size on rupture-time and creep-rate were

performed for arc-cast molybdenum at 1,600° C in hydrogen. (5) A tungsten specimen that was irradiated to a fast neutron dosage of approximately 8×10^{19} nvt ($E_n \geq 1$ Mev) resulted in a factor of 6 increase in the time-to-rupture when compared to a control specimen. The corresponding creep rate was reduced by about 70%. (6) Resistivity studies of irradiated tungsten specimens indicate that the tungsten atom transmutation to rhenium atoms results in a significant permanent increase in the resistance of the tungsten specimens. (7) Theoretical calculations show that a pressure shell subjected to isotropically incident neutrons would first become saturated at the exposed surface, and the saturation would then proceed into the shell at a rate determined by the neutron energy and shell thickness. I.v.L.

N64-22246 Royal Inst. of Tech., Stockholm (Sweden)
APPROXIMATE STRESS ANALYSIS IN ELASTIC STRUCTURES
Folke K. G. Odqvist and A. Janne Carlsson, ed. 1964 17 p refs Notes Based on Lectures by W. Prager, Royal Inst. of Tech., Stockholm, Feb. 1964
(Publ.-146)

A method for analyzing the state of stress of an elastic structure is discussed. Information concerning the following is included: (1) the principle of virtual work; (2) approximate stress analysis—relation to the Ritz' method, and relation to the method of least squares; (3) elastic continuum (approximate stress analysis)—torsion, static boundary condition, kinematic boundary condition, and relation to Trefftz' method. P.V.E.

N64-22279 General Dynamics/Convair, San Diego, Calif. Fatigue Lab.
LINEAR STRAIN THEORY AND THE SMITH METHOD FOR PREDICTING FATIGUE LIFE OF STRUCTURES FOR SPECTRUM TYPE LOADING
Clarence R. Smith Wright-Patterson AFB, Ohio, ARL, Apr. 1964 74 p refs
(Contract AF 33(616)-8228)
(ARL-64-55; GDC-63-113; AD-600879)

The linear strain theory assumes that strain at the concentration is proportional to load within practical limits. Stress at the concentration, including residual stress, can be obtained from conventional stress–strain curves, and these stresses are used in conjunction with S-N curves to evaluate fatigue life. The Smith method requires the life of a given structure in terms of a loading that is sufficiently high to insure local yielding, which corresponds to a lifetime of less than 10,000 cycles for 7075-T6 and 40,000 cycles for 2024-T3. The unique feature of the latter method is that it does not require knowledge of either nominal stresses or stress at the concentration, stress at the concentration being obtained directly from smooth specimen test data for the material from which the structure is fabricated. The stresses thus obtained are proportioned directly with the known loading, taking into account residual stresses and the order in which loads are applied. Author

N64-22293 Telecomputing Corp., San Diego, Calif. Narmco Research and Development Div.
INTERLAMINAR SHEAR OF FILAMENT-WOUND REINFORCED PLASTICS
Robert A. Elkin, Boris Levenetz, and Bud L. Duft Jan. 1964 7p refs
(Contract N60921-7094)
(QPR-2; AD-428129)

The current program status includes the following: (1) The NOL-type rings made of 20-end S-glass roving, preimpregnated with melamine resin Cymel 405, gave unsatisfactory results when tested for an improvement in interlaminar shear strength. (2) Twelve test rings have been fabricated from 12-end roving, in place of single-end roving. The roving was impregnated with an epoxy resin ERLA 0400, cured with 28.4 phr of M'phenylenediamine. I.v.L.

N64-22294 Telecomputing Corp., San Diego, Calif. Narmco Research and Development Div.
INTERLAMINAR SHEAR OF FILAMENT-WOUND REINFORCED PLASTICS
Robert A. Elkin, Boris Levenetz, and Bud L. Duft Apr. 1964 27 p refs
(Contract N60921-7094)
(QPR-3; AD-437122)

Fabrication and testing of the NOL-type ring specimens have been completed. The largest variations in shear strength occurred between the different resin systems. One of the newer epoxy resins chosen for study exhibited interlaminar shear strength of over 15,000 psi. Of particular interest, also, was the effect of winding geometry on shear strength. By winding fibers in the third planar direction, the apparent interlaminar shear strength of the specimens was increased by approximately 30%. Author

N64-22303 Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
LARGE DISPLACEMENT ANALYSIS OF BUCKLING OF AXIALLY COMPRESSED CIRCULAR CYLINDRICAL SHELLS
C. H. Tsao 27 Mar. 1964 27 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-24; TDR-269(4230-30)-3; AD-600659)

The nonlinear terms involving the radial displacement, but not those involving the meridional and circumferential displacements, are usually retained in the large displacement analysis of shells. The discarding of quadratic terms involving these latter displacements is not always a legitimate approximation, and the resulting error is difficult to estimate. The percentage error can only be ascertained by carrying out a full large-displacement analysis retaining the nonlinear terms involving these meridional and circumferential displacements. This is done for the case of the buckling of an axially compressed circular cylindrical shell. Full expressions for the membrane and bending energy densities are derived. The principle of minimum potential energy is used to determine the buckling load. It is found that the buckling load has a dependency on the thickness-to-radius ratio, t/R. For t/R approaching zero, this buckling load approaches that obtained by neglecting nonlinear meridional and circumferential displacements. For t/R equal to 0.03, the former is 4.5% higher than the latter. A curve is furnished showing the variation of the buckling load with t/R. Author

N64-22316 IIT Research Inst., Chicago, Ill.
DESIGN CRITERIA FOR GROUND-INDUCED DYNAMIC LOADS
Edward E. Hahn Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Nov. 1963 106 p refs
(Contract AF 33(657)-8231)
(RTD-TDR-63-4139, Vol. II; AD-600861)

Analyses of a vehicle to be operated on prepared surfaces are given. Both deterministic and statistical analyses are presented. For the deterministic analysis, the vehicle was considered a linear five-degree-of-freedom system—a very simplified model of an airplane. A statistical analysis of the motion of a linear one-degree-of-freedom vehicle moving on a random track is presented. This analysis is included as an introduction to random vibration analysis. A statistical analysis of the five-degree-of-freedom model is also given. R.T.K.

N64-22318 Aerospace Corp., El Segundo, Calif. Applied Mechanics Div.
ON THE FREE VIBRATIONS OF SIMPLY SUPPORTED TRUNCATED CONICAL SHELLS
Paul Seide 27 Feb. 1964 62 p refs
(Contract AF 04(695)-269)
(SSD-TDR-64-15; TDR-269-(4560-40)-2; AD-600939)

The problem of determining the bending natural frequencies and mode shapes of simply supported conical shells is investigated by a Rayleigh–Ritz solution of approximate equations of motion for the shell. Two types of simple support are considered, one for which edge circumferential displacements vanish, the other for which edge circumferential shear forces vanish. The differences between the two results are found to be quite significant when the circumferential wave number is small. Although a general explicit expression for the natural frequencies of conical shells appears to be unobtainable, several approximations are illustrated, and a simple expression for the minimum frequency is obtained. Author

N64-22326 J. G. Engineering Research Associates, Baltimore, Md.
ELASTIC AND PLASTIC BEHAVIOR OF CYLINDRICAL SHELLS UNDER DYNAMIC LOADS BASED ON ENERGY CRITERIA
Joshua E. Greenspon Feb. 1963 26 p refs
(Contract DA-36-034-ORD-3081 RD)
(TR-3; AD-402180)

A theory for the dynamic elastoplastic deformations of thin shells is presented. The deformation is obtained by equating the energy input to the energy absorbed by the structure. Large deflections and strain hardening are considered. The theory is applied to the case of a shell undergoing axially symmetric collapse. Author

N64-22452 Battelle Memorial Inst., Columbus, Ohio Defense Metals Information Center
HYDROGEN-INDUCED, DELAYED, BRITTLE FAILURES OF HIGH-STRENGTH STEELS
A. R. Elsea and E. E. Fletcher 20 Jan. 1964 160 p refs
(Contract AF 33(615)-1121)
(DMIC-196; AD-601116)

Steel subjected to a tensile stress that exceeds some critical value, depending on the strength level of the steel, and that contains hydrogen that is free to move, is susceptible to failure in a delayed, brittle manner. The problem is especially serious because the minimum stress for failure decreases as the strength of the steel is increased and because failures occur with no appreciable ductility, although in a tensile test the material may exhibit normal ductility. Under most conditions the strength level of the steel is the most important factor affecting the occurrence of delayed, brittle failure. Both the minimum applied stress that will result in failure and the time required for the failure to occur decrease as the tensile strength of the steel is increased. These failures occur in all types of steel microstructures except austenite. Alloy composition is a relatively unimportant factor in the hydrogen-induced, delayed, brittle failure of body-centered cubic steels. Such failures depend directly on the hydrogen content of the steel. Since this type of failure involves time for the diffusion of hydrogen, it occurs under low-strain-rate or static-load conditions. Author

N64-22464* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DYNAMIC TEST RESULTS OF SAD-6
Gale R. Ernsberger 6 Apr. 1964 209 p refs
(NASA-TM-X-53029) OTS: $14.00 ph

The purpose of these vibration tests is to determine the body bending and torsional dynamic behavior of a full-scale prototype of the Saturn SA-6 flight vehicle. A full-scale prototype was vertically suspended in the test tower and excited by shakers mounted at the engine gimbal planes. The vehicle's dynamic response at various applied forcing frequencies was recorded by vibration pickups. Since the Saturn is stabilized and controlled by a servoloop, response measurements are needed to properly design the control-system filter circuits, thus preventing vehicle dynamic instability. The SAD-6 vehicle was tested both for the boost flight with the S-I booster stage and for the S-IV powered flight with the S-I stage removed. Author

N64-22504 Stanford U., Calif.
FINITE INDENTATION OF AN ELASTIC MEMBRANE BY A SPHERICAL INDENTER Technical Report
N. M. Bhatia and W. Nachbar Feb. 1964 35 p refs
(Grant DA-ARO(D)31-124-G464)
(SUDAER-182; AROD-3106.3; AD-600743)

Rotationally symmetric stresses and deformations are considered for a prestressed elastic sheet of circular outer boundary loaded transversely by a centered indenter with a hemispherical tip. A nonlinear membrane solution is obtained for the portion of the sheet that is in frictionless contact with the rigid tip of the indenter. This solution and the solution that was previously obtained for a prestressed annular membrane are used to obtain the exact solution for stresses and deflections in the indented membrane. Simpler, limiting expressions for stresses and deflections are also obtained for sufficiently large and sufficiently small indenter loads. Comparison of computed results from this analysis with the experimental results of Jahsman, Field, and Holmes on stretched mylar membranes shows good agreement except in the immediate neighborhood of the indenter. The theory shows that yielding and plastic deformation of the membrane is incipient for a relatively small value of the indenter load, and for these experiments, this limiting value is less than the least value of indenter load for which data were reported. Author

N64-22661 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.
EFFECT OF CONCENTRICAL RIBS ON THE FREQUENCY OF FREE OSCILLATIONS OF ROUND AND RING SHAPED PLATES
N. P. Fleyshman and O. M. Shabliy 9 Oct. 1963 9 p refs
Transl. into ENGLISH from Prikl. Mekhan. (UKR.), v. 7, no. 3, 1961 p 326–331
(FTD-TT-63-810; AD-425501)

The frequency of free oscillations of a ring-shaped plate was determined theoretically and experimentally. The investigation was conducted on a ring-shaped, thin, isotropic plate, with the edges fastened by two concentrically thin, hollow rings (ribs) of constant lateral cross section and made of different material from the plate. The calculated results and the experimental results were found to differ by 2.4%. P.V.E.

34 STRUCTURAL DESIGN

Includes structural elements; and weight analysis. *For related information see*: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 33 Stresses and Loads

N64-21654 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

RESOLUTIONS OF THE COORDINATION COMMITTEE ON THE SUBJECT "STRENGTH OF THIN-WALLED CONSTRUCTIONS"

V. S. Gumenyuk 2 Jan. 1963 8 p Transl. into ENGLISH from Pryk. Mekh. (Kiev), v. 7, no. 1, 1961 p 110–112
(FTD-TT-62-1624/1; AD-295772)

Among the resolutions adopted by the committee are the following: (1) to study equations of state, to formulate a general theory of elastic–plastic deformations of solid bodies, and to establish a relationship between the physicochemical mechanism of deformation of solids and the mechanical elastic–plastic properties of materials; (2) to develop theoretical and experimental methods of determining plastic deformations, strength and carrying ability of structures, and machines and installations under heavy stresses; (3) to investigate strength and plasticity of structural elements in the presence of "aggressive" media; (4) to investigate creep and permanent strength of structures exposed to complex stresses, at changed loads, under irregular and nonstationary temperature distribution, and at high and ultrahigh pressures; (5) to investigate the strength of materials at very high and also very low temperatures; and (6) to formulate a general nonlinear theory of stability of deformation processes of a solid medium. D.E.W.

N64-21747 Lehigh U., Bethlehem, Pa. Fritz Engineering Lab.

FURTHER STUDIES OF THE MOMENT-THRUST-CURVATURE RELATIONSHIP

M. G. Lay and N. Gimsing Jan. 1964 46 p refs
(Contracts NOBS-90041; NBY-53160)
(Rept.-297.4; AD-434754)

The relationship between bending moment, axial force, and curvature is basic to the study of structures. The problem was solved theoretically in a number of ways, but the experimental aspect has received less attention. This report gives some experimental confirmation of the predicted behavior. On an overall scale, the existing theories provide an adequate representation of the behavior, although allowance must be made for the occurrence of local buckling. On a localized scale the agreement between test and theory is not consistently reliable, and it becomes apparent that the overall theory is an average representation of the number of dissimilar conditions. However, this average representation appears adequate for most structural purposes. Author

N64-21772 Lehigh U., Bethlehem, Pa. Fritz Engineering Lab.

THE DUCTILITY OF STEEL STRUCTURES

Theodore V. Galambos and Maxwell G. Lay Mar. 1964 53 p refs
(Contract NObs-90041; NBY-5310)
(Rept.-297.5; AD-434271)

The inelastic load-deformation response of beams, beam-columns, and beam-and-column subassemblages that are subjected to static unidirectional loading is examined. The response criterion for a member is the end moment–end rotation relationship. It is shown, both from experimental and theoretical considerations, that the inelastic load-deformation behavior of wide-flange steel frames and frame components can be predicted and that the energy absorption capacity of these frames can be assessed. Author

N64-22039 Air Force Systems Command, Wright-Patterson AFB, Ohio Foreign Technology Div.

NONLINEAR OSCILLATIONS OF MECHANICAL AND STRUCTURAL ELEMENTS

N. V. Grigor'yev 10 Feb. 1964 316 p refs Transl. into ENGLISH from the Book "Nelineynyye Kolebaniya Elementov Mashin i Sooruzheniy" Moscow, Gos. Nauchno-Tekhn. Izd. Mashinostroitel'noy Lit., 1961 p 1–225
(FTD-TT-62-1197/1+2; AD-432080)

The book discusses nonlinear oscillations in beams, rotors, blades, and composite systems of the rotor-frame type. Critical processes in shafts with nonlinear supports are examined. Relationships are established between the functional conditions and vibration states of turbines. Methods based on the properties of the nonlinear oscillations of elastic systems are developed to help forestall critical operating conditions and transverse oscillations of machine elements. Author

N64-22059 Advisory Group for Aeronautical Research and Development, Paris (France)

THE INTEREST OF AERONAUTICAL ENGINEERS IN HYDROFOIL DEVELOPMENT

Patroclus J. Yangos (Roy. Hellenic AF Acad.) Jul. 1963 53 p refs Presented at the 23rd Meeting of the AGARD Flight Mech. Panel, Athens, 8–10 Jul. 1963
(AGARD-473)

This report emphasizes the aeronautical engineer's interest and possible contribution toward the development of hydrofoil craft, discussed in terms of fluid dynamics, flight mechanics, avionics, structures and materials, and propulsion. As a preamble, the hydrofoil's aeronautical heritage is underlined and its proper place in the transportation spectrum is explored, together with an endeavor to factually defend this vehicle against underestimation of its usefulness and capability. The report closes with a presentation of contemporary hydrofoils and examination of the projects now in the course of materialization. As an epilogue, the aeronautical engineer is invited to cooperate closely with the naval architect and is warned against an undiluted contribution to hydrofoil art, such as indiscriminate application of aerospace techniques to stability and control problems and other sophisticated technologies, which may endanger the viability of the future hydrofoil. Author

N64-22215 Southampton U., (Gt. Brit.) Inst. of Sound and Vibration Research

THE PROPAGATION OF FATIGUE CRACKS BY RANDOM PRESSURES IN A TURBULENT BOUNDARY LAYER

B. L. Clarkson and S. A. Pietrusewicz Feb. 1964 79 p refs
(ISAV-Memo-104)

This report described tests carried out on tensioned aluminum alloy steets 24in. × 10in. × 0.064in. containing a central crack running at right angles to the overall tensile load. The test specimens were vibrated by random acoustic pressures simulating the pressure fluctuation in a turbulent boundary layer. The rate of propagation of the crack due to the acoustic pressures only was measured. The vibration characteristics of the plate and the crack propagation rate are closely related to the condition of the free edge of the crack. For short crack lengths, the rate of propagation is very low but the rate increases as the crack length increases, until buckling occurs. Thereafter, the rate does not change greatly with increase in crack length. The effect of stiffeners attached to the specimen was also studied. Author

N64-22262 Boeing Co., Seattle, Wash.

X-20 TRUSS INTERNAL LOADS CALCULATION PROCEDURE

A. F. Grisham [1964] 163 p
(Contract AF 33(657)-7132)
(D2-81242; AD-434024

This document describes the approach taken to the problem of obtaining deflections and internal loads for X-20 glider truss structure subjected to external loads and thermal gradients. The formulation of classical structural analysis theory in matrix algebra terminology is described along with methodology developed for applying the formulation to the truss structure. Included is a discussion of (1) the representation of physical and geometric properties of the structure in matrix form; (2) execution of formulated matrix equations; (3) techniques for operating with partitions of matrices where the matrices are larger than present computer programs can handle; (4) checks necessary to insure validity of all solutions obtained; (5) use of unit load systems to reduce computer expense and provide an economical tool for parameter studies; and (6) choice of input and output data forms and formats. Author

N64-22315 IIT Research Inst., Chicago, Ill.
DESIGN CRITERIA FOR GROUND-INDUCED DYNAMIC LOADS Technical Documentary Report, Mar. 1962–Oct. 1963
Edward E. Hahn Wright-Patterson AFB, Ohio, Res. and Technol. Div., Nov. 1963 201 p
(Contract AF 33(657)-8231)
(RTD-TDR-63-4139, Vol. I; AD-600923)

The purpose of this research program was to collect all available measured prepared surface profile and power spectral data, to ascertain their reliability, to establish from these data design criteria for vehicles operating on prepared surfaces, and to demonstrate the applicability of these design criteria. All of the known power spectral density and profile data sets that were compiled in the United States and by NATO are described. Power spectral density curves are given for those data sets that do not appear in U.S. Government documents. The procedures used for calculation of these power spectral densities are examined, and recommendations as to which power spectral densities were accurately computed are made. Design criteria for vehicles operating on runways, taxiways, or ramps are established in the form of power spectral densities and discrete pumps. Author

N64-22422 Case Inst. of Tech., Cleveland, Ohio
STRUCTURAL SYNTHESIS RESEARCH PROGRAM Semi-annual Progress Report, Dec. 1, 1963–May 31, 1964
L. A. Schmit, Jr. [1964] 9 p refs
(Grant NsG-110-61)
(NASA-CR-56480) OTS: $1.10 ph

The following projects are included in a synthesis program to bring a more meaningful class of design problems within the grasp of rational and directed optimization based on a knowledge of the governing technology: (1) the optimum design of a double wedge airfoil where the governing technology is aeroelasticity; (2) minimum weight design of a three-layer heat shield; (3) extension of the shock isolator synthesis capability; (4) studies in depth of the integrated analysis–synthesis concept; (5) studies of conducting structural synthesis within the framework of reliability based on design philosophy; (6) development of a synthesis capability for a class of plate- and shell-type structures; and (7) investigation of using existing techniques from the mathematical programing area in the structural synthesis concept. M.P.G.

N64-22487 Royal Inst. of Tech., Stockholm, (Sweden)
ASYMMETRICAL LOADING OF CONICAL SHELLS
Age Walöen 1963 36 p refs *Its* Transactions no. 218, Mech. Eng. 13
Elanders Boktryckeri Aktiebolag, Göteborg: 4.50 Kronor

Partial differential equations are developed for a conical shell with arbitrary load. Numerical results have been obtained with a digital computer for a number of cases with lateral force and moment vectors acting on the apex of the cone. The influence of changing the cone angle or shell thickness is examined. Author

N64-22502 Curtiss-Wright Corp., Wood-Ridge, N.J. Wright Aeronautical Div.
DESIGN, DEVELOPMENT AND FABRICATION OF ULTRA-HIGH STRENGTH SOLID PROPELLANT ROCKET MOTOR CASES Quarterly Progress Report No. 4, 20 Feb.–20 May 1964
W. Eichberg and E. P. Gilewicz [1964] 71 p refs
(Contract AF 04(611)-9064)
(WAD-R-407-4; AD-600745)

Case SN1 burst at a pressure of 1,076 psig, corresponding to a Pr/t burst stress of 375,000 psi. A total of five 6-in. diam subscale burst tests, using test bottles, representing the same heats of material in the full-scale cases are also discussed. The Pr/t test results on these bottles ranged from 346,000 psi to 375,000 psi, complementing the highly successful full-scale burst. A metallurgical analysis of the tested case and bottles was conducted and is presented to establish the mode of fracture origination and progression. Author

N64-22509 Georgia Inst. of Tech., Atlanta Engineering Experiment Station
DESIGN AND DEVELOPMENT OF AN E-M WINDOW FOR AIR LIFT REENTRY VEHICLES Interim Engineering Report 1 Feb. - 30 Apr. 1964
N. E. Poulos, C. A. Murphy, J. N. Harris, J. M. Wolf, and J. D. Walton, Jr. Wright-Patterson AFB, Ohio, AF Avionics Lab., 30 Apr. 1964 50 p
(Contract AF 33(657)-11504)
(IER-4; AD-440772)

Investigations were initiated to define the filament-winding parameters that optimize the load-bearing capabilities of filament-wound fused silica radome structures. Brittle ring tensile tests were completed on unmodified and Cr_2O_3 modified fused silica rings at six different temperatures between ambient and 2,200° F. Contrary to generally expected material behavior, fused silica exhibits increasing strength with increasing temperature. An explanation is presented for this behavior, based on molecular spacing. Teflon coatings application techniques and sealing efficiency determinations of these coatings on slip-cast fused silica were initiated. An apparatus to measure the sealing efficiency of Teflon coatings was constructed. A 2-ft diam × 4-ft-high slip-cast fused silica ogival electromagnetic window was successfully cast in a plaster mold. The step-by-step procedure used in casting this shape is presented with photographs. Author

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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